

August 1991

Participant

Service Training

# 100 Macintosh Service Course

## Prerequisite Manual — Volume 1



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## Prerequisite Manual — Volume 1



Service Training

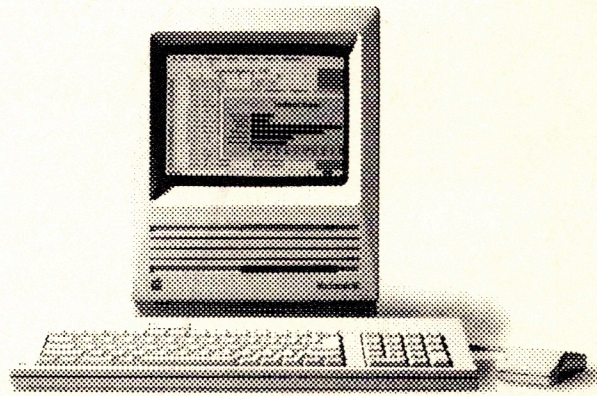
Participant

August 1991



# Macintosh Service Course Prerequisite Manual – Vol. 1

Participant's Manual







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# **Macintosh Service Course Prerequisite Manual – Vol. 1**

Student Guide

Welcome to Apple Service

Understanding ESD

Macintosh Basic Features

Setting Up Macintosh Computers

Using Macintosh Computers

 Apple Computer, Inc.

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# Welcome To Apple Service

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# Module Introduction

## Overview

This module outlines your role as a technician who services and repairs Apple products. It presents the Apple repair strategy, explains the Service Technician's responsibilities to Apple's customers, lists the resources available to technicians, and describes Apple computers and peripheral products that technicians must be able to recognize and repair.

## What You Will Learn

By the end of this module, you should be able to:

- Identify the major Apple products
- Match compatible peripheral devices to Apple II and Macintosh computers
- Identify Apple repair strategy and the role played by Service Technicians
- Identify the resources Apple provides to Apple Service Technicians

The Skills Checklist following this Introduction lists, in detail, the tasks you should be able to perform upon completion of this module.

## How You Will Be Tested

**The Module Test** This written test will help you verify that you can perform the tasks outlined in the Skills Checklist.

**Prerequisite Exam** This exam consists of hands-on and written items. It will verify that you have mastered the module skills listed and are ready for the lab part of this course.

Throughout all of the tests and exercises, you will be able to refer to these instructional materials and to other Apple reference materials.

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# Module Introduction

## How the Module Is Organized

This module is presented in two parts:

**Part 1: Introduction to Apple Products** describes Apple's two product families and major peripheral devices. The exercise in the last section provides practice identifying important Apple products.

**Part 2: Service Technician's Role** describes Apple's modular repair strategy, the service technician's role in the repair process, and the support structure available to the technician.

## How to Use this Module

Go through the sections in the order presented. Afterward, go over the Skills Checklist and review any sections that you are uncertain about.

**Continue with the Skills Checklist on the following page.**

---

# Skills Checklist

## **What Is the Skills Checklist?**

This is a list of tasks that you should be able to perform at the conclusion of this module. The Prerequisite Exam (written and hands-on) will cover these items. During the lab part of the course, you will be expected to perform all of these tasks.

## **How to Use the Checklist**

Before starting the module, you should check the items on this list. If you are confident that you can already perform certain tasks, you may decide to skip those parts of the module. Or you may decide to try the Module Test without going through the module.

After completing the module, you should check this list to make certain that you have mastered all of the skills before you attend the Prerequisite Exam and the lab part of this course. If you feel uncertain about any of these tasks, return to the section indicated, review the information, and repeat the hands-on exercises.

Task	Where the Task Is Covered
___ 1. Correctly identify the major Apple products, including Apple II and Macintosh computers and peripheral devices.	Introduction to Apple Products
___ 2. Identify if peripheral devices are compatible with a given Apple II or Macintosh computer.	Introduction to Apple Products
___ 3. Identify Apple's modular repair strategy and how it impacts the role of service technician.	Apple Repair Strategy
___ 4. Identify the resources Apple provides for handling the four main categories of problems encountered by technicians.	Working with Apple: Service and Support
___ 5. Identify the first step in the escalation path a technician should follow when gathering technical information.	Working with Apple: Service and Support

**Continue with the next section, Introduction to Apple Products.**

# Introduction to Apple Products

## Overview

To service Apple products effectively, you must::

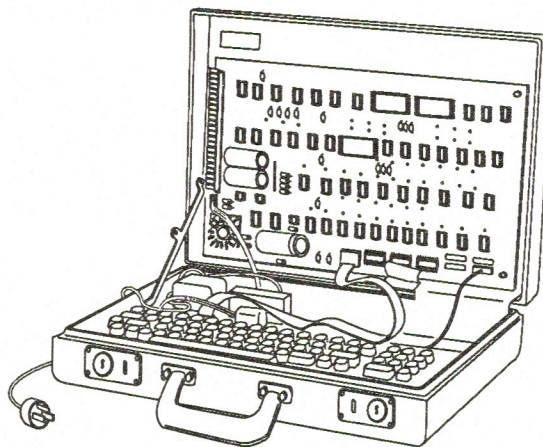
- Be able to distinguish between different products
- Know which Apple products are compatible (will work with each other)

This section will introduce the main product lines and major Apple products, and describe product compatibility.

An overview of the entire Apple product family will be presented first.

## The Apple Family

In 1976, Apple co-founder Steve Wozniak created one of the first personal computers. Wozniak's Apple I, shown in Figure 1, eventually evolved into the Apple II family of personal computers.



**Figure 1. The Apple I**

With the introduction of the Macintosh in 1984, Apple created a new family of computers. Currently Apple manufactures over 20 different products, including printers, modems, keyboards, monitors, and hard drives, as well as the Apple II and Macintosh computers. As Apple Service Technicians, you will service *all* Apple products you are authorized to service, including those no longer being manufactured.

The chart in Figure 2 shows the evolution of the main Apple product lines since 1976. Seeing how the different product families have evolved will help you understand the product compatibility issues discussed later on in this section.

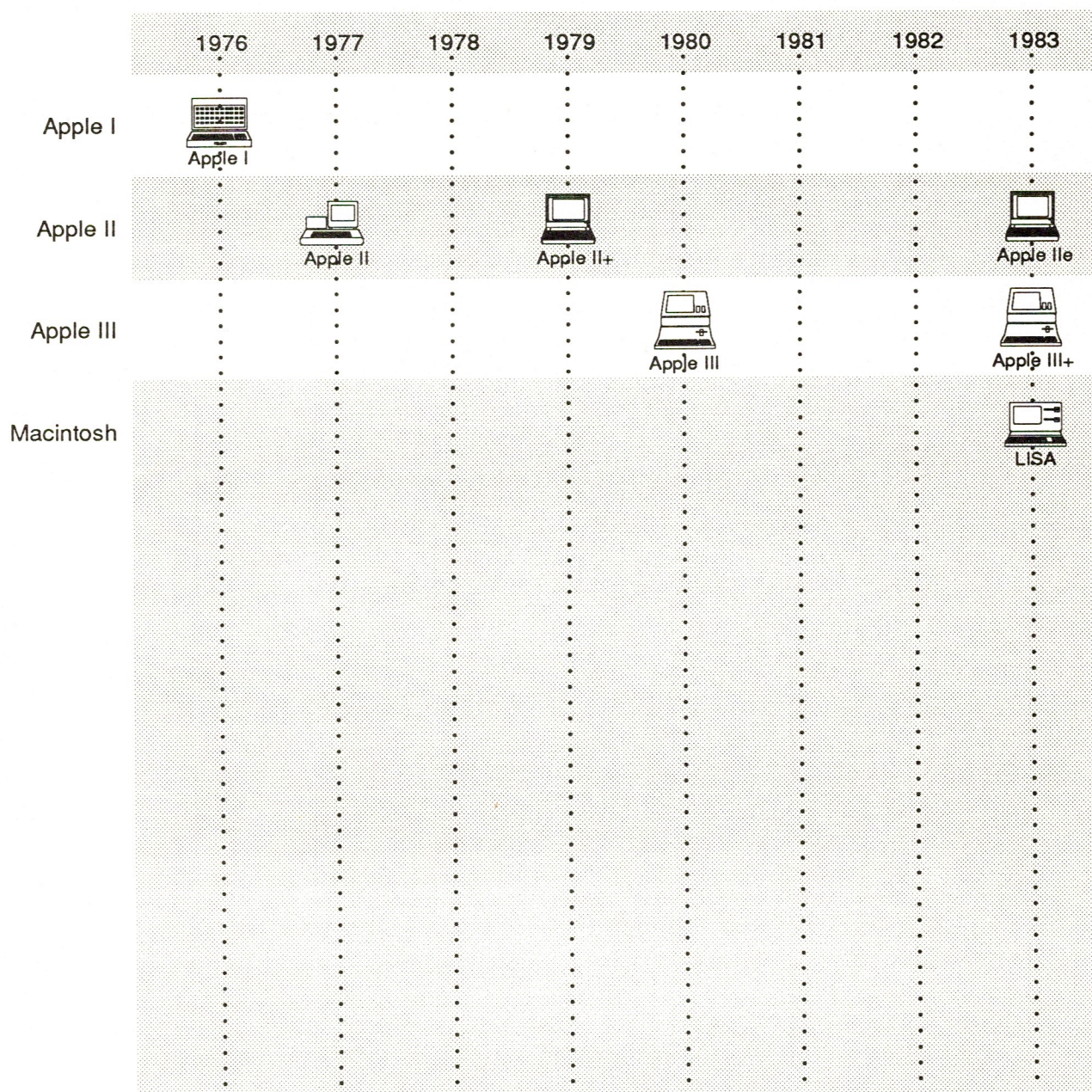


Figure 2a. The Apple and Macintosh Families

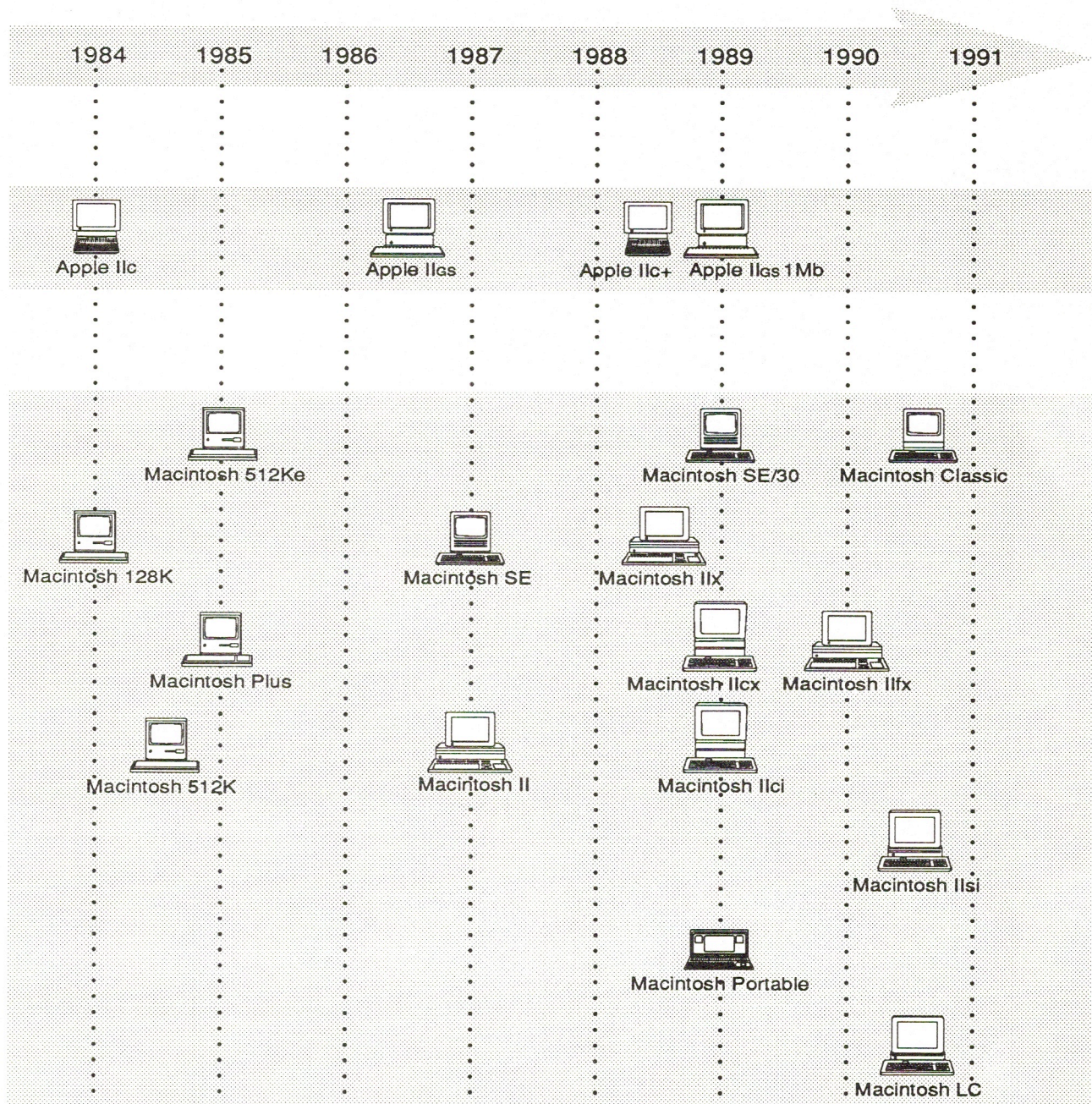


Figure 2b. The Apple and Macintosh Families continued

The two families of computers serve different types of users. Apple II computers are designed primarily for education, small business, and home use. They are based on the Motorola 6500 family of microprocessors.

Macintosh computers are designed to serve a wide range of corporate applications, particularly in publishing, television, graphic arts, business, and finance. They also serve higher education, research, and personal use. They are based on the Motorola 68000 family of microprocessors.

### Design Types

The Apple computers may be grouped into four categories:

- Apple II modular
- Macintosh modular
- Macintosh compact
- Macintosh portable

Compact designs have the monitor's power source and drives built into the computer.

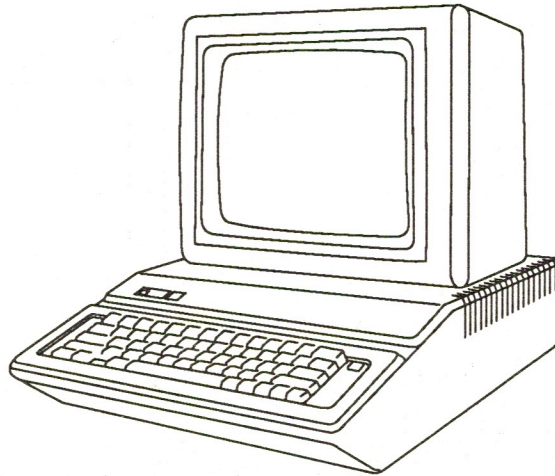
Modular designs have detached monitors and a number of expansion slots for interface cards.

Portable designs are compact, and lightweight, and allow users to travel with their computers.

This module describes the Apple computers in detail and groups them according to the four design categories.

### Modular Apple II Systems

All Apple II computers have a modular design. Drives (with the exception of the Apple IIc and Apple IIc Plus) and monitors are separate from the computer. Most models have expansion slots for add-on cards.

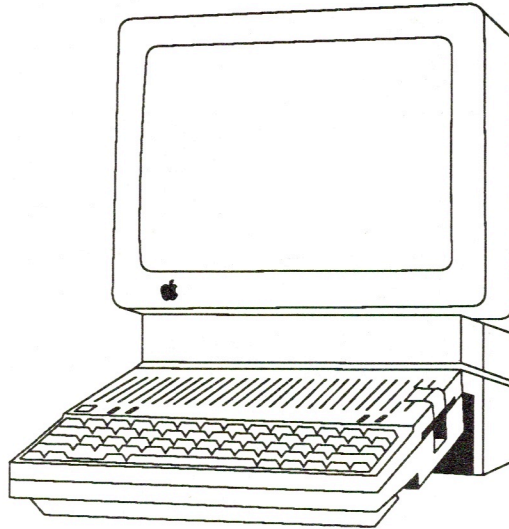
*Apple IIe***Figure 3. Apple IIe**

## Features:

- Keyboard: Built-in, 81 keys
- Disk drives: Detached 3.5-inch 800K floppy; and/or 5.25-inch 143K floppy drive
- Microprocessor: Motorola 6502 (later versions use 65C02)
- Clock speed: 1.02 MHz
- Memory: 128K RAM, expandable to 1MB; 16K ROM
- Slots: 7 multipurpose expansion slots
- Ports: Game port, video jack, audio cassette minijacks
- Monitors: Monochrome and National Television Standards Committee (NTSC)-compatible color

Most peripheral devices, such as printers, modems, and disk drives, are connected through interface cards in the expansion slots. Other interface cards can provide for many different kinds of applications, including graphics, music, and sound effects. The low cost and large base of educational software make this the most popular computer in elementary, middle, and high schools.

### *Apple IIc*

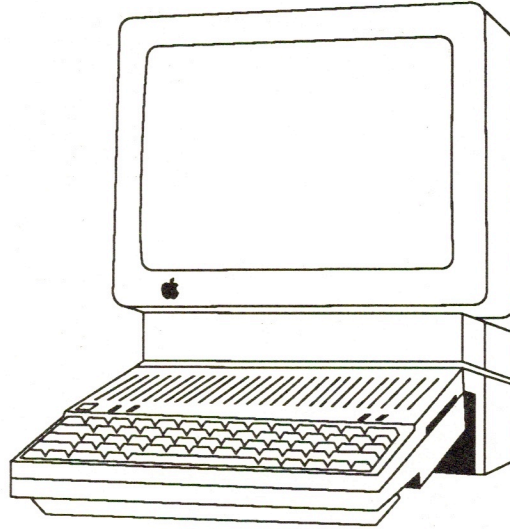


**Figure 4. Apple IIc**

#### Features:

- Keyboard: Built-in, 63 keys
- Disk drives: Built-in 5.25-inch 143K floppy; external 5.25-inch 143K floppy; external 3.5-inch 800K floppy drive
- Microprocessor: Motorola 65C02
- Clock speed: 1.02 MHz
- Memory: 128K RAM, expandable to 1MB; 32K ROM
- Slots: None
- Ports: Printer, modem, extra disk drive, RGB monitor, mouse/joystick, composite monitor
- Monitors: Monochrome, NTSC-compatible color, and Red-Green-Blue (RGB) color

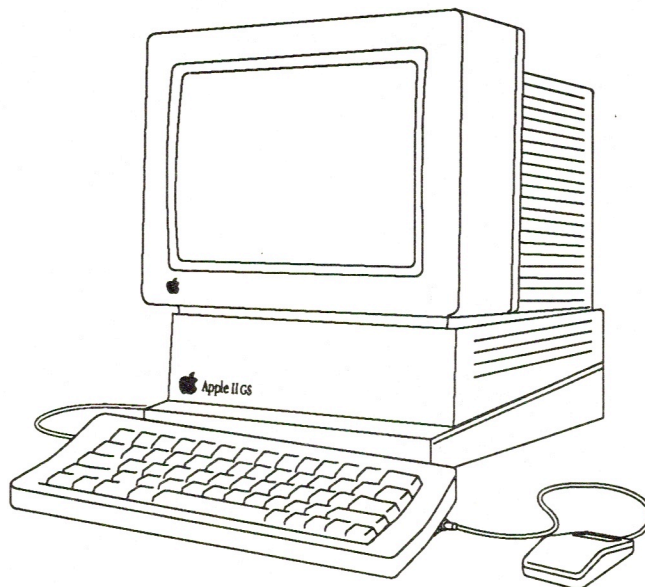
Peripheral ports connect printers, drives, modems, and monitors without the need for interface cards in expansion slots. The built-in disk drive and the lack of expansion slots make the Apple IIc more compact and easier to set-up than the Apple IIe, but less flexible. Designed for home and small business use, the Apple IIc has an external transformer connected to the power cord and nonstandard printer and modem ports.

**Apple IIc Plus****Figure 5. Apple IIc Plus****Features:**

- Keyboard: Built-in, full-sized
- Disk drives: Built-in 3.5-inch 800K floppy; detached 3.5-inch 800K floppy; detached 5.25-inch 143K floppy drive
- Microprocessor: Motorola 65C02
- Clock speed: 1.02 or 4 MHz
- Memory: 128K RAM, expandable to 1.12 MB; 32K ROM
- Slots: None
- Ports: Standard printer and modem ports, extra disk drive, RGB monitor, mouse/joystick, composite monitor
- Monitors: Monochrome, NTSC-compatible color, and RGB color

This model is much like the Apple IIc, except that it has a larger keyboard, standard modem and printer ports, 3.5-inch drive, an internal transformer, and standard power cord. The Apple IIc Plus also has two different clock speeds, allowing it to run some applications up to four times faster than the Apple IIc.

### *Apple IIgs*



**Figure 6. Apple IIgs**

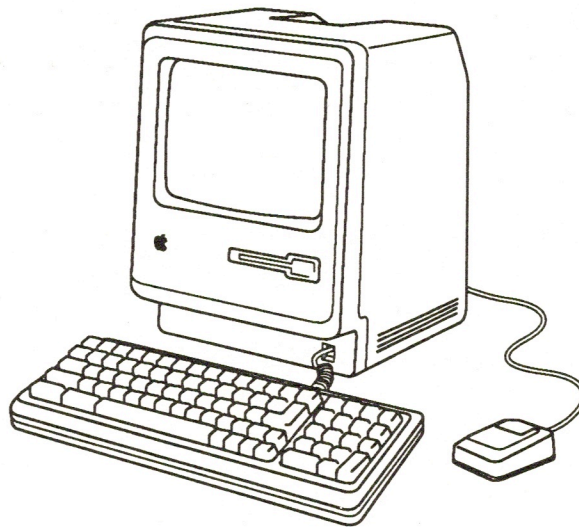
**Features:**

- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Detached 3.5-inch 800K floppy; 5.25-inch 143K floppy drive
- Microprocessor: Motorola 65C816
- Clock speed: 1.0 or 2.8 MHz
- Memory: 1MB RAM, expandable to 8 MB; 128K ROM
- Slots: 7
- Ports: Printer, modem, disk drive, RGB monitor, game I/O, composite monitor, stereo headphone jack, keyboard/mouse
- Monitors: Monochrome, NTSC-compatible color, and RGB color

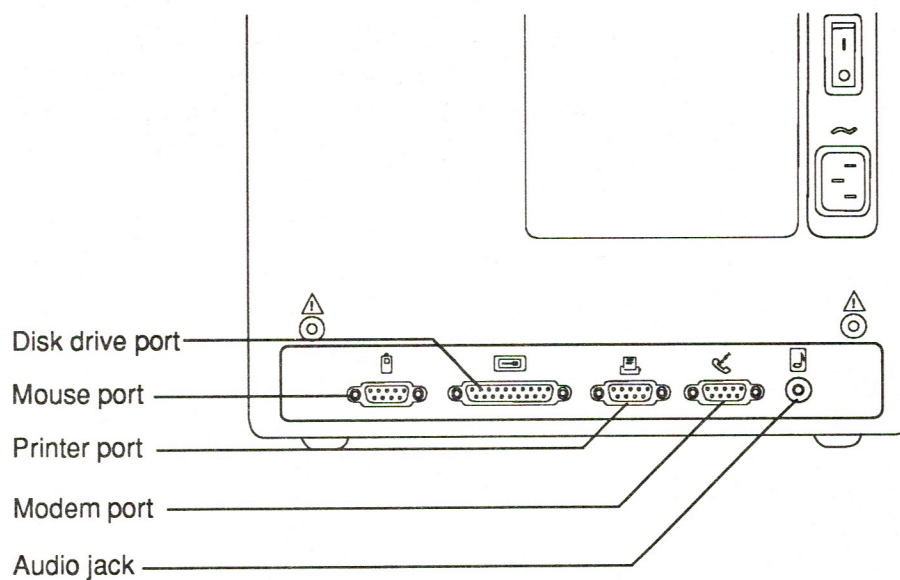
The Apple IIgs, with its detached keyboard, monitor, and drives, is the most modular of the Apple II family. It features both ports and slots, larger memory, faster microprocessor, and enhanced sound and video capabilities. It will run most of the old Apple II software plus the new Apple IIgs software.

**Compact Macintosh Systems**

The compact Macintosh design consolidates the monitor, drive, and central processing unit into one compact and transportable unit. Keyboards are detached. The mouse (an input device) is necessary for operation. Peripherals are connected by ports. Two of the compact Macintosh models (the Macintosh SE and Macintosh SE/30) have a single expansion slot that will support external monitors and other peripheral devices.

***Macintosh 512K***

**Figure 7. The Macintosh 512K**

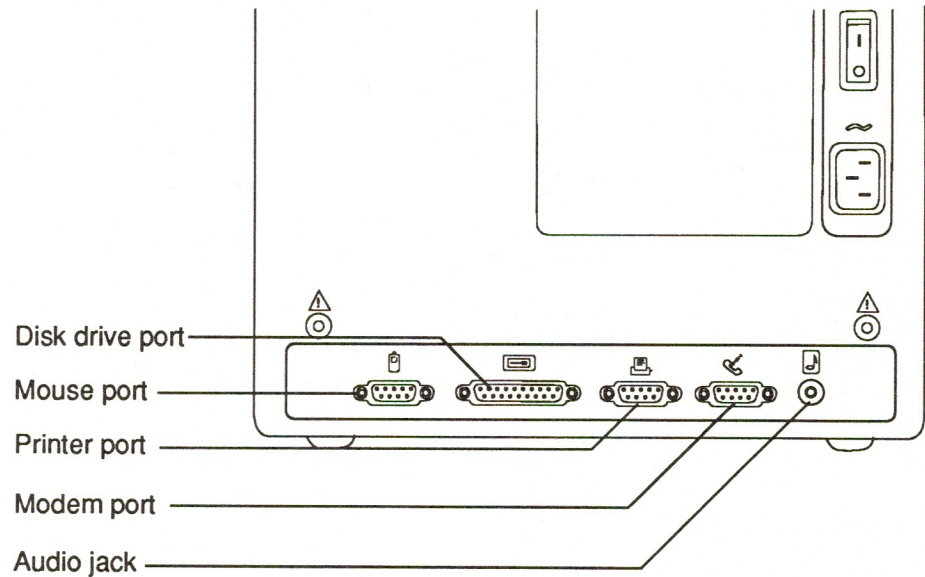


**Figure 8. Back panel of the Macintosh 512K (Note port icons.)**

Features:

- Keyboard: Detached (no numeric key pad)
- Disk drives: Built-in 3.5-inch 400K floppy, external 3.5-inch 400K floppy drive
- Microprocessor: Motorola 68000
- Clock speed: 7.886 MHz
- Memory: 512K RAM, 128K ROM
- Slots: None
- Ports: Printer, modem, drive, mouse
- Monitors: Built-in, monochrome

The second Macintosh, the 512K, supports only 3.5-inch 400K floppy drives. The keyboard cable plugs into a telephone-like connector in the front of the computer. The mouse connects to a separate port on the back panel. The first Macintosh (the Macintosh 128K) was identical to the 512K except it had 128K of RAM.

*Macintosh 512Ke***Figure 9. Back panel of the Macintosh 512Ke**

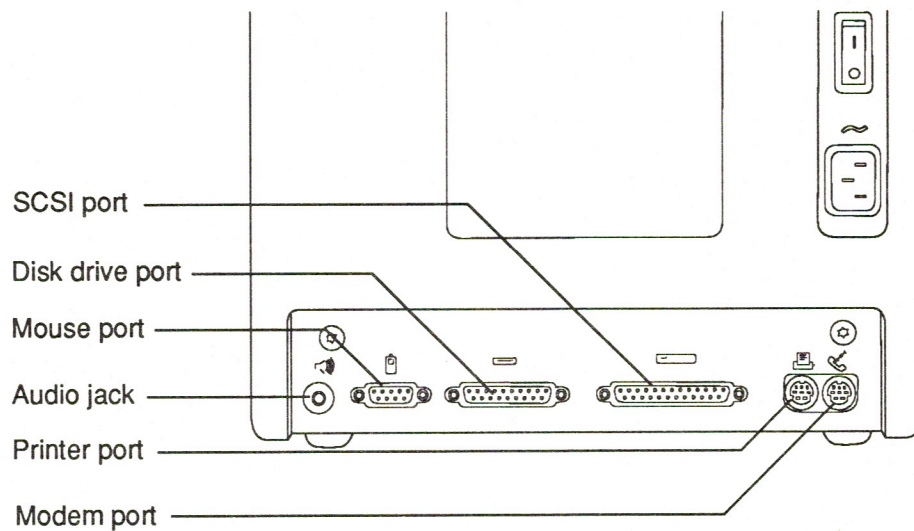
## Features:

- Keyboard: Detached (no numeric key pad)
- Disk drives: Built-in 3.5-inch 800K floppy; external 3.5-inch 400K floppy; external 3.5-inch 800K floppy drive
- Microprocessor: Motorola 68000
- Clock speed: 7.886 MHz
- Memory: 512K RAM, 256K ROM
- Slots: None
- Ports: Printer, modem, drive, mouse
- Monitors: Built-in, monochrome

The Macintosh 512Ke differs from the 512K in two ways:

- The disk drive supports both single-sided 400K floppy disks and double-sided 800K floppy disks.
- A new, expanded ROM supports the 800K drive and the hierarchical file system.

**Macintosh Plus**



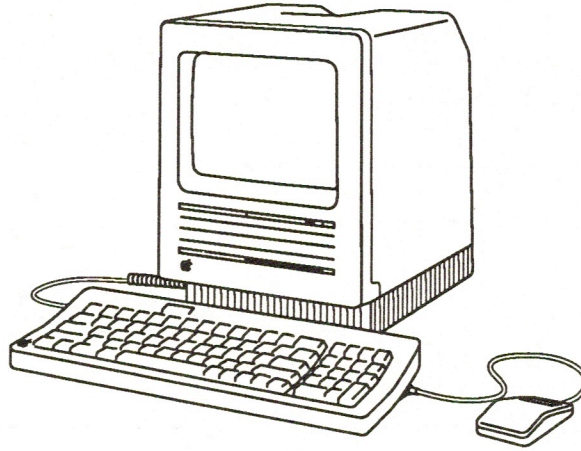
**Figure 10. Macintosh Plus back panel (Note port icons.)**

**Features:**

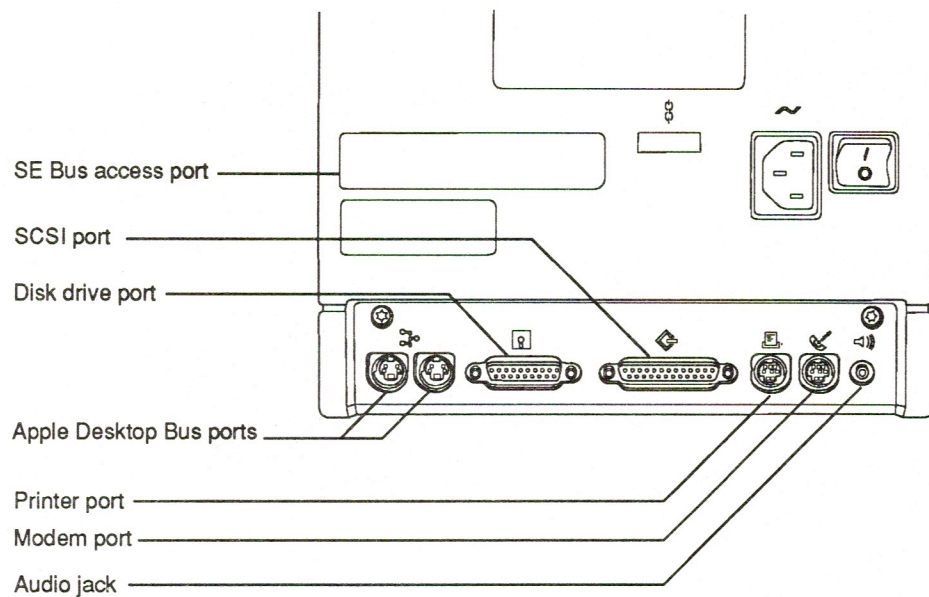
- Keyboard: Detached, raised, "tactile" keys
- Disk drives: Built-in 3.5-inch floppy 800K; external 3.5-inch floppy 800K drive
- Microprocessor: Motorola 68000
- Clock speed: 7.8336 MHz
- Memory: 1MB RAM expandable to 4MB; 128K ROM
- Slots: None
- Ports: Modem, printer, SCSI, drive, audio, mouse
- Monitors: Built-in, monochrome

The Macintosh Plus has nearly twice the RAM available in the Macintosh 512K and 512Ke. The SCSI (Small Computer System Interface) port connects with SCSI devices, such as hard drives. Mini-8 connectors (standard serial) have replaced the DB-9 connectors for the printer and modem ports.

*Macintosh SE*



**Figure 11. The Macintosh SE**



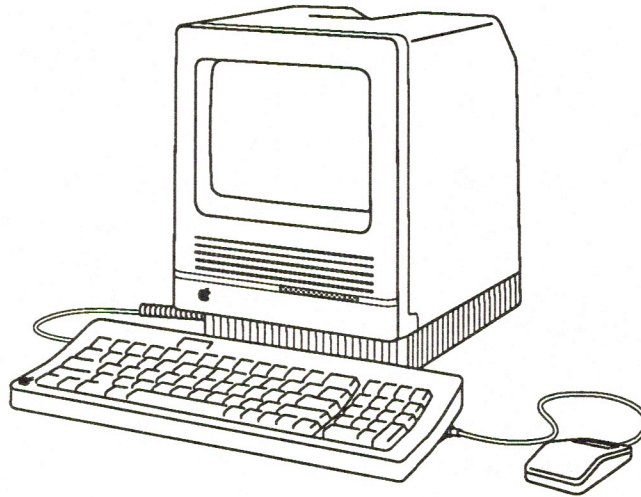
**Figure 12. Macintosh SE back panel**

**Features:**

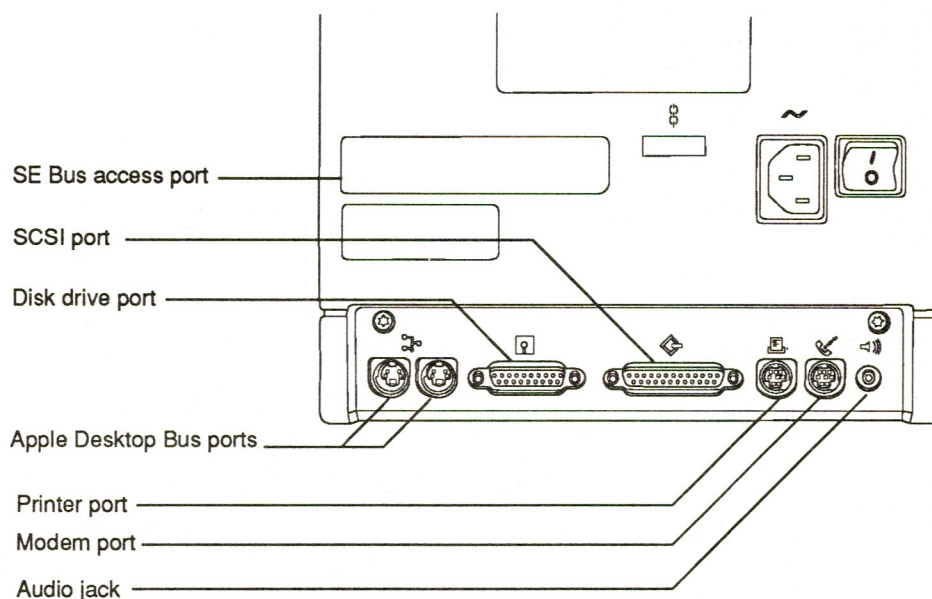
- **Keyboard:** Detached, full-sized, with numeric keypad
- **Disk drives:** Built-in 3.5-inch floppy (800K or SuperDrive 1.44 MB) and internal 20MB or 40MB hard drives (also comes with dual floppy disk drives); external 3.5-inch floppy 800K or 1.44MB drive
- **Microprocessor:** Motorola 68000
- **Clock speed:** 7.8336 MHz
- **Memory:** 1MB RAM, expandable to 4 MB; 256K ROM
- **Slots:** One
- **Ports:** Printer, modem, external drive, SCSI, 2 keyboard/mouse, audio
- **Monitors:** Built-in, monochrome

The keyboard and the mouse plug into the same port (Apple Desktop Bus) on the back panel. The keyboard includes a numeric keypad and "sculpted" keys. The mouse can also be plugged into the keyboard. The single expansion slot is available for interface and add-on cards. The SE comes with two internal drives, either two floppy drives or a floppy drive and a hard drive.

*Macintosh SE/30*



**Figure 13. The Macintosh SE/30**



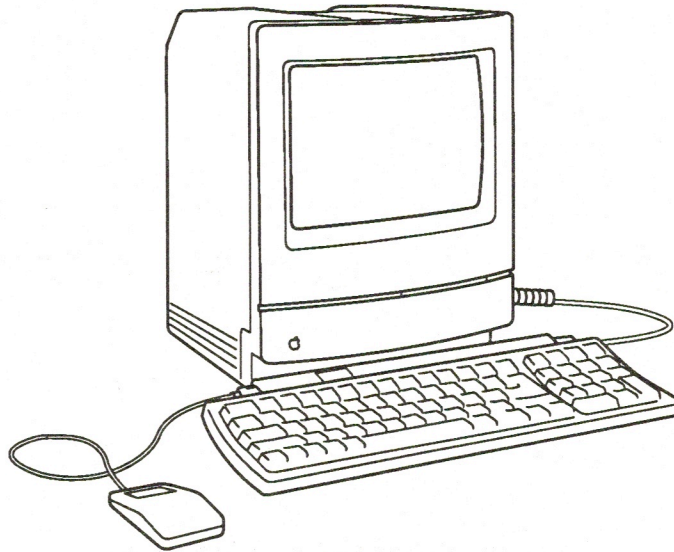
**Figure 14. Macintosh SE/30 back panel**

**Features:**

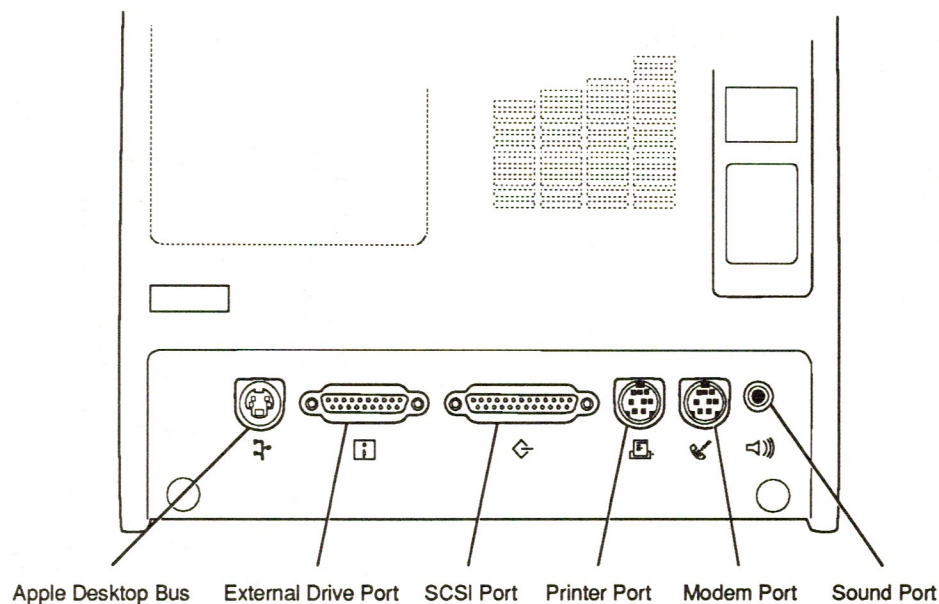
- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy, and internal 40MB or 80MB hard drives; external 3.5-inch 1.44MB floppy drive
- Microprocessor: Motorola 68030
- Clock speed: 16 MHz
- Memory: 1 or 2 MB RAM, expandable to 8 MB; 256K ROM
- Slots: One
- Ports: Printer, modem, external drive, SCSI, 2 keyboard/mouse, audio
- Monitors: Built-in, monochrome

From the outside, the SE/30 is almost identical to the SE. Inside it features a newer and faster microprocessor, larger memory, a 1.44 MB floppy drive, and 40MB hard drive in its standard configuration.

*Macintosh Classic*



**Figure 15. The Macintosh Classic**



**Figure 16. Macintosh Classic back panel**

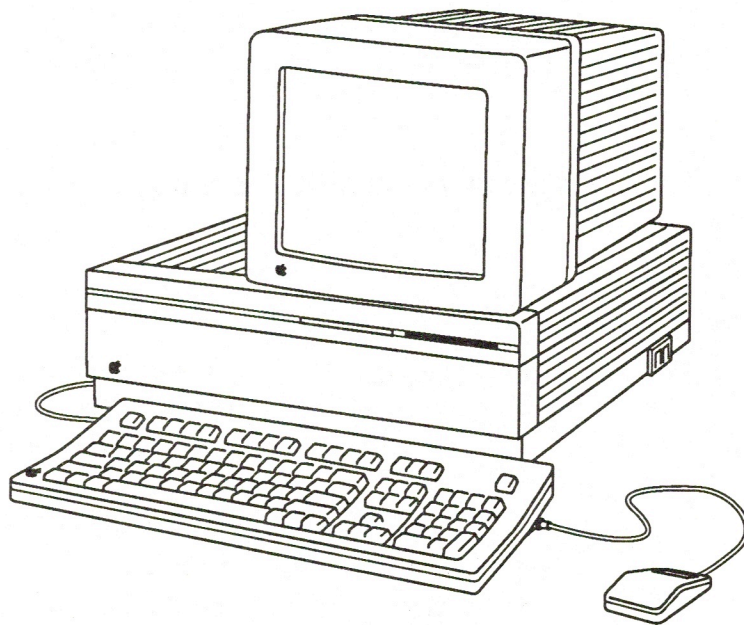
**Features:**

- Keyboard: Any ADB Apple keyboard, with numeric keypad
- Disk drives: Built-in SuperDrive (1.4 MB floppy drive); optional internal 40 and 80 MB Apple SCSI hard drives; optional external Apple SCSI hard drive
- Microprocessor: Motorola 68000
- Clock speed: 8 MHz
- Memory: 1 or 2 MB of RAM, expandable to 4 MB RAM (2 SIMM sockets memory expansion board available); 512K ROM
- Slots: None
- Ports: ADB port for keyboard and mouse, two serial ports for printer and modem, one external floppy drive port, SCSI interface, sound port
- Monitors: Built-in 9-inch high-resolution display

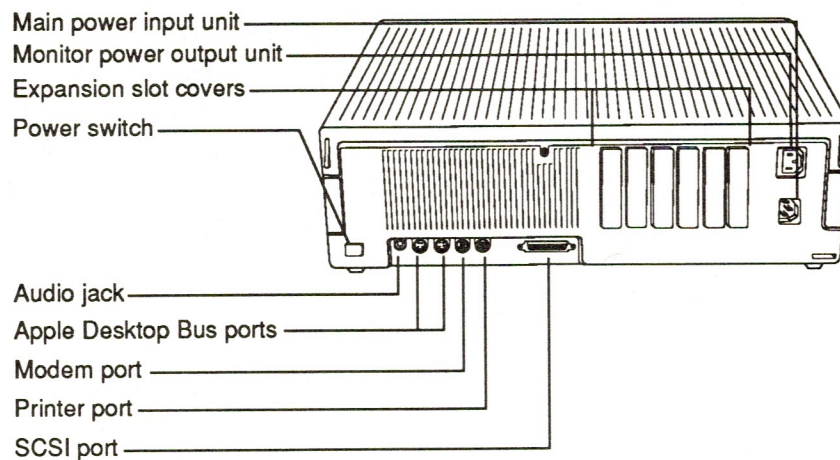
From the outside the Classic looks similar to the Macintosh Plus. However, it is 25% faster than the Macintosh Plus. The Classic does not have a coprocessor. Unlike other compact models, the Classic comes with 512K of ROM. Memory expansion on the Classic is different from that of the other compact models. The second megabyte of memory is added by installing an optional memory expansion board that is unique to the Macintosh Classic. Total memory may be increased to four megabytes. The Classic has only one ADB port.

**Modular Macintosh Systems**

There are presently seven modular Macintosh computers: the Macintosh II, Macintosh IIfx, Macintosh ILCx, Macintosh ILCi, Macintosh IIfx, Macintosh IIsi, and the Macintosh LC. Each of these modular computer systems has a monitor, keyboard, and mouse that are separate from the computer. Although the drives are built-in, the monitors are detached, and most models have several expansion slots for add-on cards.

***Macintosh II***

**Figure 17. The Macintosh II**



**Figure 18. Macintosh II back panel**

**Features:**

- Keyboard: Detached, standard or extended, with numeric keypad
- Disk drives: Built-in 3.5-inch 800K floppy, and internal 40, 80, or 160MB hard drives (also comes with dual floppy drives)
- Microprocessor: Motorola 68020
- Clock speed: 15.7 MHz
- Memory: 1 MB RAM, expandable to 8MB; 256 ROM
- Slots: Six NuBus
- Ports: Printer, modem, SCSI, 2 keyboard/mouse, audio
- Monitors: Detached monochrome or RGB color available

The Macintosh II is much larger than the Macintosh SE. It has six, instead of one, expansion slots, a faster microprocessor (the Motorola 68020), and supports color display. A NuBus card is required to support video.

**Macintosh IIx**

The Macintosh IIx from the outside looks identical to the Macintosh II. It has a faster microprocessor and comes with a 1.44MB floppy drive.

## Features:

- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy, and internal 40, 80, or 160MB hard drives
- Microprocessor: Motorola 68030
- Clock speed: 16 MHz
- Memory: 1 MB RAM, expandable to 8MB; 256 ROM
- Slots: Six NuBus
- Ports: Printer, modem, SCSI, 2 keyboard/mouse, audio
- Monitors: Detached monochrome or RGB color available (requires NuBus video card)

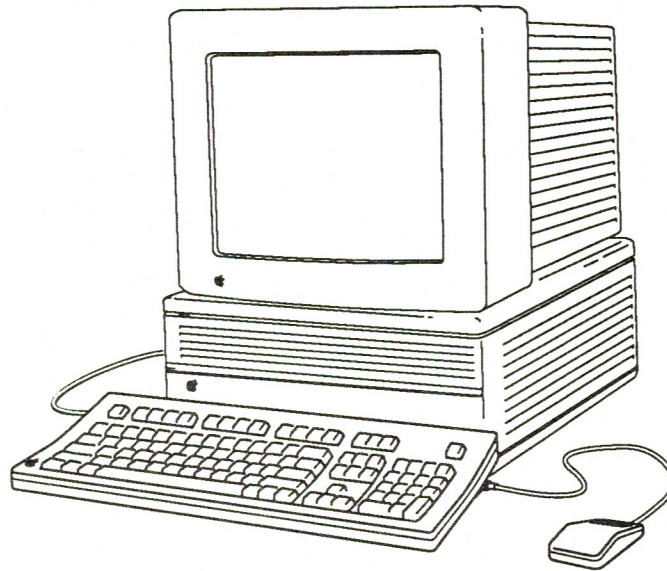
**Macintosh IIfx**

The Macintosh IIfx from the outside looks identical to the Macintosh II and IIx. It is faster than the Macintosh II and IIx (Motorola 68030 at 40 MHz) and has a math coprocessor.

## Features:

- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy, and internal 40, 80, or 160MB hard drives
- Microprocessor: Motorola 68030 with built-in page memory management unit (PMMU)
- Clock speed: 40 MHz
- Memory: 4 MB RAM, expandable to 2, 5, or 8MB; 4 MB of 60 nsec parity RAM available, expandable to 8 MB; 512K ROM
- Slots: Six NuBus and one 120-pin processor direct slot
- Ports: Printer, modem, SCSI, 2 keyboard/mouse, stereo
- Monitors: Detached monochrome, RGB color, portrait display or two-page monochrome available (requires NuBus video card)

*Macintosh IIcx*



**Figure 19. The Macintosh IIcx (shown with the AppleColor Hi-Resolution RGB Monitor)**

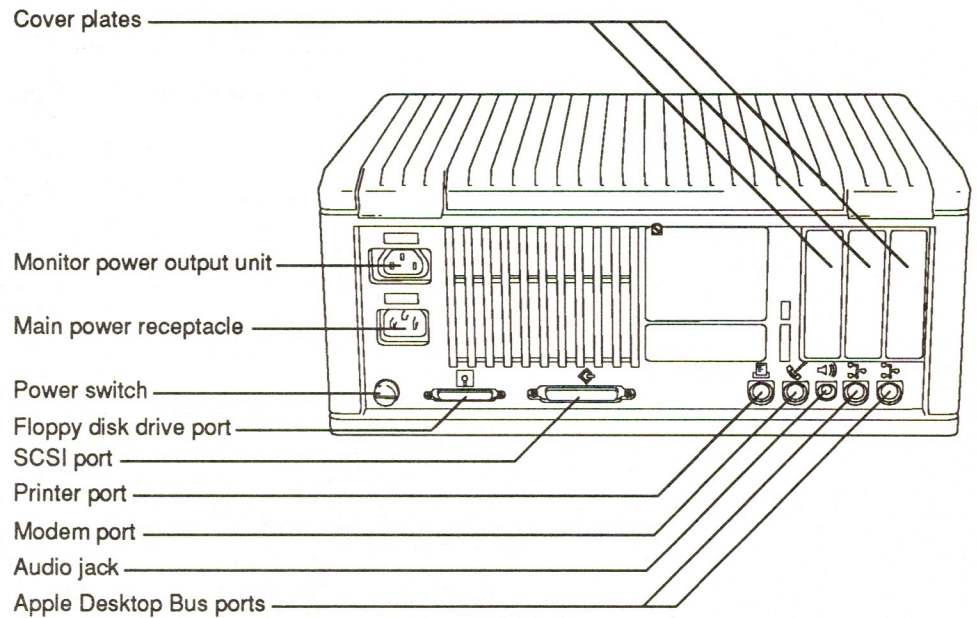


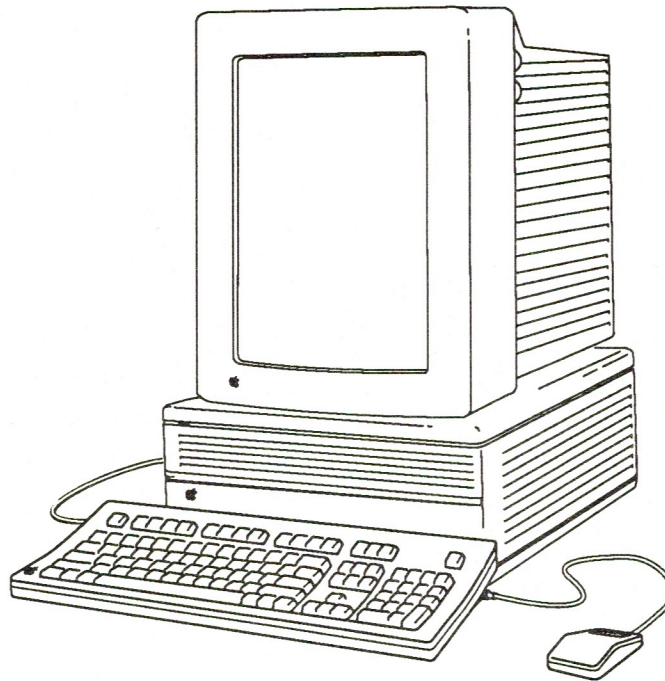
Figure 20. Macintosh IIcx back panel

Features:

- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy and 40 or 80 MB internal hard drives; external 3.5-inch floppy 800K; external 3.5-inch floppy 1.44MB drive
- Microprocessor: Motorola 68030
- Clock speed: 16 MHz
- Memory: 1 MB RAM, expandable to 8MB; 256 ROM
- Slots: Three NuBus
- Ports: Printer, modem, SCSI, external drive, 2 keyboard/mouse, audio
- Monitors: Detached monochrome or RGB color available

The Macintosh IIcx is significantly smaller than the Macintosh II. It has three, instead of six expansion slots, a faster microprocessor (the Motorola 68030), and a 1.44 MB floppy drive. A NuBus card is required to support video.

### *Macintosh IIfx*



**Figure 21. The Macintosh IIfx (shown with the Portrait Display Monitor)**

The Macintosh IIfx is similar in appearance to the Macintosh IIfx. However, the IIfx processor runs at 25 Mhz, and video can be supported through a NuBus video card or directly from the video port.

**Features:**

- Keyboard: Detached, full-sized, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy and 40 or 80 MB internal hard drive; external 3.5-inch floppy 800K; external 3.5-inch floppy 1.44MB drive
- Microprocessor: Motorola 68030
- Clock speed: 25 MHz
- Memory: 1 MB RAM, expandable to 8MB; 512K ROM
- Slots: Three NuBus
- Ports: Printer, modem, SCSI, external drive, 2 keyboard/mouse, audio, built-in video
- Monitors: Detached monochrome or RGB color available

*Macintosh IIsx*

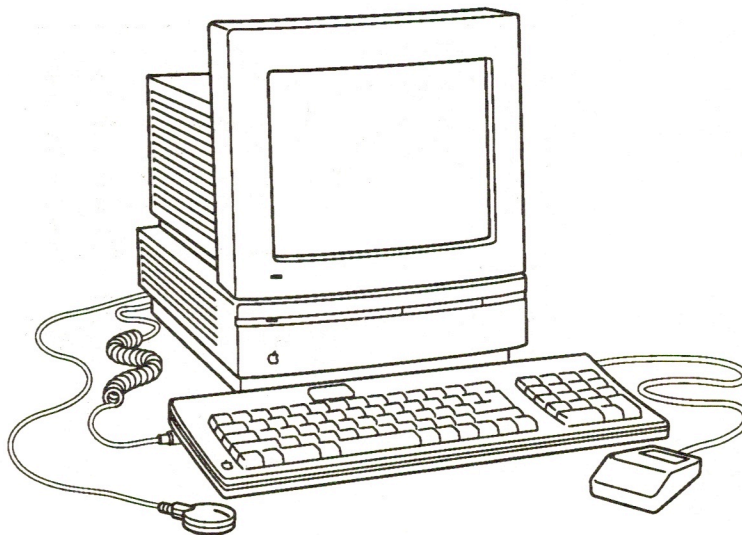
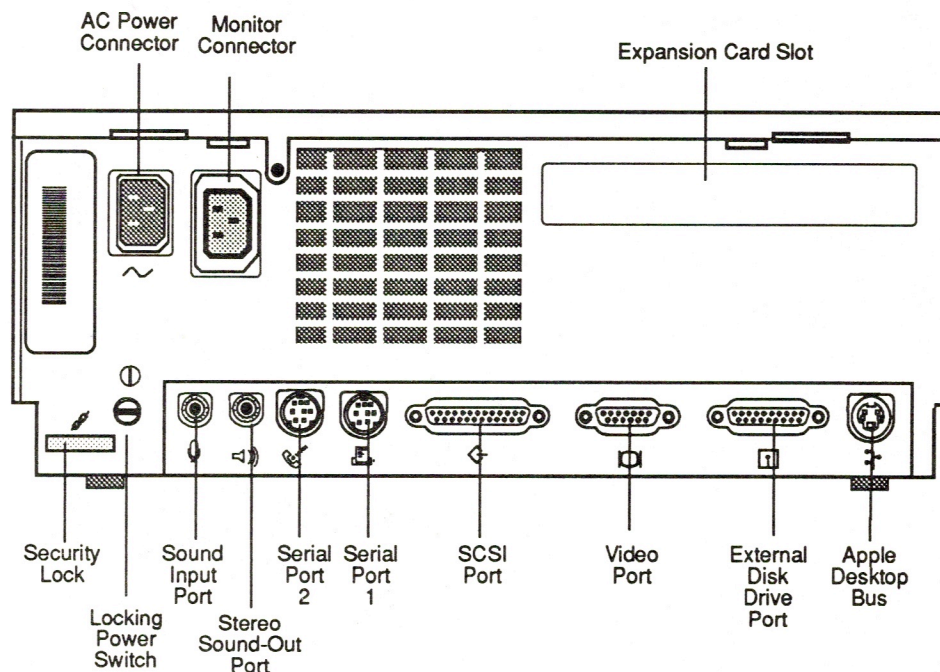


Figure 22. Macintosh IIsx



**Figure 23. Macintosh IIsx back panel**

Features:

- Keyboard: Standard or extended, with ADB connector
- Disk drives: SuperDrive 1.4 MB floppy drive, optional external 1.4 MB or 800K drive available
- Microprocessor: Motorola 68030, optional coprocessor
- Clock speed: 20 MHz
- Memory: 2 MB RAM, expandable to 17 MB; 512K ROM
- Slots: One for NuBus or internal expansion card
- Ports: One ADB for use with keyboard/mouse, video port, two serial ports, external floppy drive, SCSI, stereo output port, monaural sound input port
- Monitors: Built-in video supports Apple Hi-Res Monochrome, Macintosh 12-inch Monochrome Display, Macintosh 12-inch RGB Display, AppleColor Hi-Res RGB, Apple Portrait Display
- Microphone

The Macintosh IIsx is different from the other modular Macintosh computers. It is smaller in size and requires a video card to work with the Apple Two-Page monitor.

*Macintosh IILC*

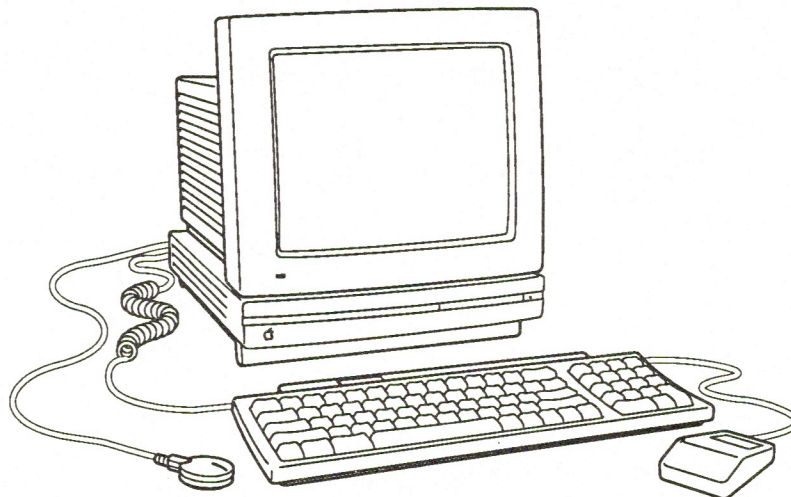
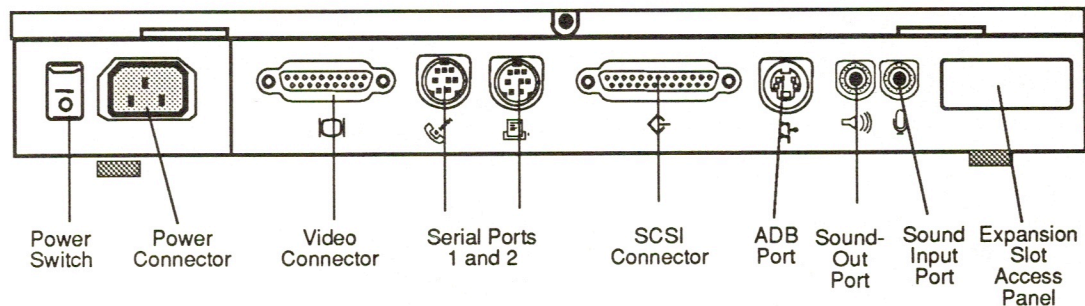


Figure 24. Macintosh LC

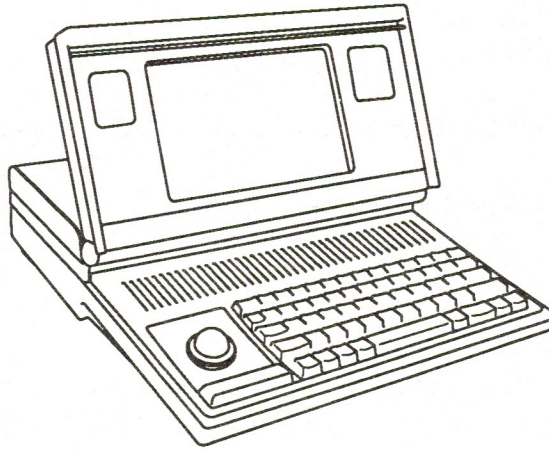


**Figure 25. Macintosh LC back panel**

**Features:**

- Keyboard: ADB keyboard, with numeric keypad
- Disk drives: Built-in 3.5-inch 1.44 MB floppy, 40 MB internal SCSI hard drive available, as well as two external 3.5-inch 1.4 floppy drives
- Microprocessor: Motorola 68020
- Clock speed: 16 MHz
- Memory: 2 MB RAM, expandable to 4MB; 512K ROM
- Slots: One for use with processor-direct expansion card
- Ports: Printer, modem, SCSI, external floppy drive, 2 keyboard/mouse, monaural, built-in video, sound output for monophonic, sound input for monaural
- Monitors: Macintosh 12-inch RGB Display, Macintosh 12-inch Monochrome Display, AppleColor Hi-Res RGB
- Microphone

The Macintosh LC is smaller in size than the other modular Macintosh computers and does not have a coprocessor. Both the Macintosh IIx and the LC have built-in video and both have only one expansion slot (although the slots are not the same). The Macintosh LC is not compatible with the Apple Portrait display or the Apple Two-Page monitor.

**Portable Macintosh System****Figure 26. The Macintosh Portable****Features:**

- **Input:** Built-in full-sized keyboard, trackball, optional numeric keypad, optional low-power mouse
- **Disk drives:** Built-in 3.5-inch 1.44 MB floppy and 40 MB internal hard drive (or available with dual floppy drives)
- **Microprocessor:** Motorola low-power 68000
- **Clock speed:** 16 MHz
- **Memory:** 1 MB RAM, expandable to 2MB; 256K ROM
- **Slots:** Three NuBus
- **Ports:** Printer, modem, SCSI, external drive, 1 keyboard/mouse, audio, power adapter, video out
- **Monitors:** Built-in active matrix LCD display, detached monochrome available through video adapter

The Portable Macintosh computer runs on a battery and has a built-in disk drive, keyboard, and LCD display. The Macintosh Portable can use either a built-in trackball or a mouse.

### Peripherals

Peripheral devices fall into three categories: input devices, output devices, and storage devices.

#### *Input Devices*

Input devices put information into the computer. They include:

- Input controls (keyboards, mouse devices, joysticks, etc.)
- Scanners (for inputting images)
- Modems

#### *Output Devices*

Output devices allow information in the computer's memory to be printed, displayed on a screen, or sent over telephone wires. They include:

- Printers
- Monitors
- Modems

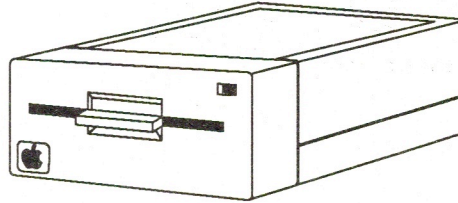
#### *Storage Devices*

Storage devices take information from the computer memory and store it as electronic impulses on disk or tape. They also allow the computer to access information stored on disk or tape. They include:

- Floppy drives
- Hard drives
- CD ROM and tape drives

The following pages illustrate the major Apple peripheral products that are currently manufactured.

### Apple 5.25 Drive



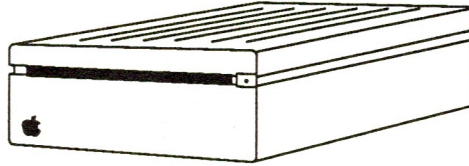
**Figure 27. Apple 5.25 Drive**

#### Features:

- Formatted data capacity: 143 kilobytes per disk
- Data surfaces: 1
- Data transfer rate: 250 kilobits per second
- Disk rotational speed: 299 rpm
- Tracks per surface: 35
- Number of read-write heads: 1
- Weight: 2.17kg (4.78 lb.)

The Apple 5.25 Drive is a floppy drive that uses removable, single-sided 5.25-inch disks to store and retrieve data. The Apple 5.25 Drive is compatible with all Apple II computers, but it is not compatible with Macintosh computers.

## Apple 3.5 Drive

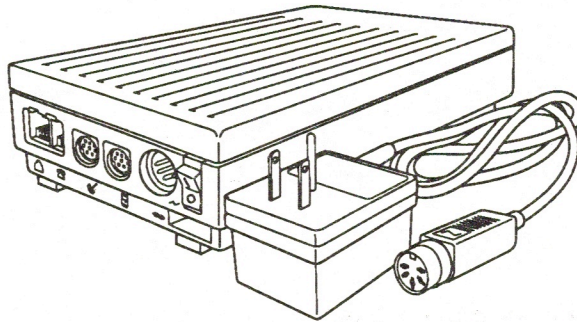


**Figure 28. Apple 3.5 Drive**

### Features:

- Formatted data capacity: 819.2 kilobytes per disk
- Data surfaces: 2
- Data transfer rate: 489 kilobits per second
- Disk rotational speed: Up to 590 rpm
- Tracks per surface: 160
- Number of read-write heads: 2
- Weight: 1.39kg (3.05 lb.)

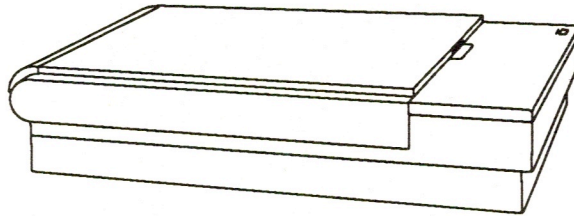
The Apple 3.5 Drive is a floppy drive that uses removable, 3.5-inch disks to store and retrieve data. The Apple 3.5 Drive is compatible with the Apple IIGS, the Macintosh 512Ke, Macintosh Plus, Macintosh SE, and Macintosh SE/30.

**Apple Data Modem 2400****Figure 29. Apple Data Modem 2400****Features:**

- Data format: Serial, binary, asynchronous, odd, even, or no parity
- Communications standards:
  - 300bps Bell 103
  - 1200 bps Bell 212A
  - 1200bps CCITT V.22A/B
  - 2400bps CCITT V.22bis
- Transmission modes: Full duplex, asynchronous, error corrected

The Apple Data Modem 2400 is designed to send and receive data over the public switched telephone network. The Data Modem 2400 is compatible with all Apple II and Macintosh computers.

### Apple Scanner

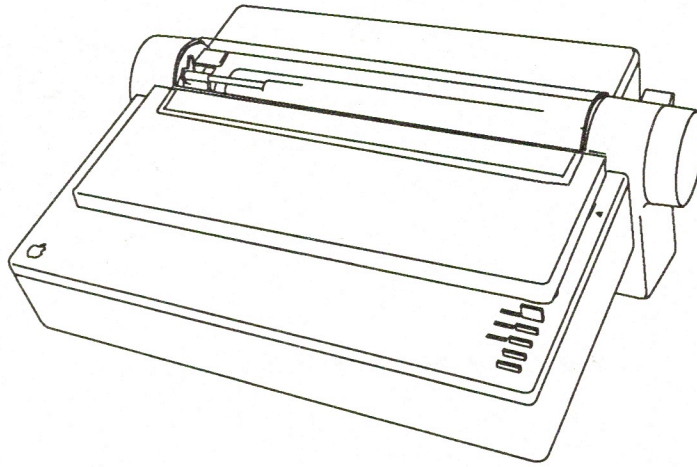


**Figure 30. Apple Scanner**

#### Features:

- Type: Flatbed
- Maximum document size: 8.5 by 14.0-inch
- Interface: SCSI
- Composition types: Line art, halftone, grey scale
- Output resolution: 75 to 300 dpi
- Weight: 9.07kg (20 lbs.)

The Apple Scanner captures any two-dimensional image that fits on its flatbed scanning surface. The result is an image file which can be manipulated in a variety of ways. The Apple Scanner is compatible with Macintosh computers that use SCSI. With third-party software the Apple Scanner can be used with Apple II computers that use SCSI.

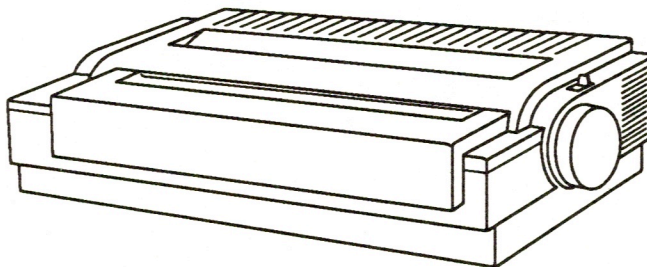
**ImageWriter II and II/L****Figure 31. ImageWriter II and II/L****Features:**

- Print method: Dot matrix
- Print quality: Draft, correspondence, near letter quality (NLQ)
- Printing speed: 250 cps, 180 cps, 45 cps
- Line feed speed: Up to 24 lps
- Character format: 12 x 8, 7 x 8, 16 x 16, 16 x 8
- Standard characters: 96 ASCII (alphanumeric and symbols), 28 European language, 32 MouseText
- Weight: 6.7kg (15 lbs.)

The Apple ImageWriter II is a dot matrix impact printer that is compatible with all Apple II and Macintosh computers.

The Apple ImageWriter II/L is a modified service version of the ImageWriter II. The features remain the same; however, the internal design of the printer has changed.

## ImageWriter LQ

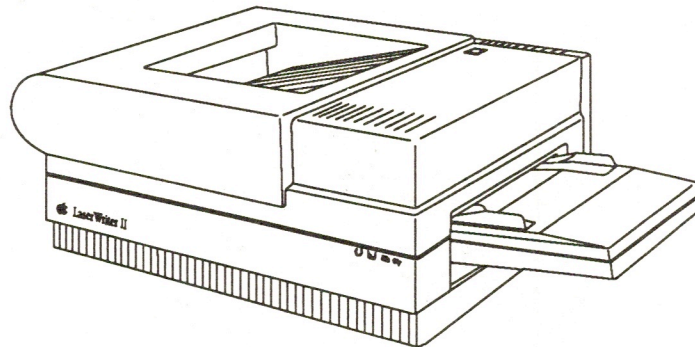


**Figure 32. ImageWriter LQ**

### Features:

- Print method: Dot matrix
- Print quality: Draft, near letter quality, letter quality
- Printing speed: 250 cps, 145 cps, 115 cps, 90 cps
- Character format: 12 x 8, 16 x 24
- Standard characters: 96 ASCII (alphanumeric and symbols), 28 European language
- Line feed speed: Up to 24 lps
- Weight: 17 kg (38 lbs.)

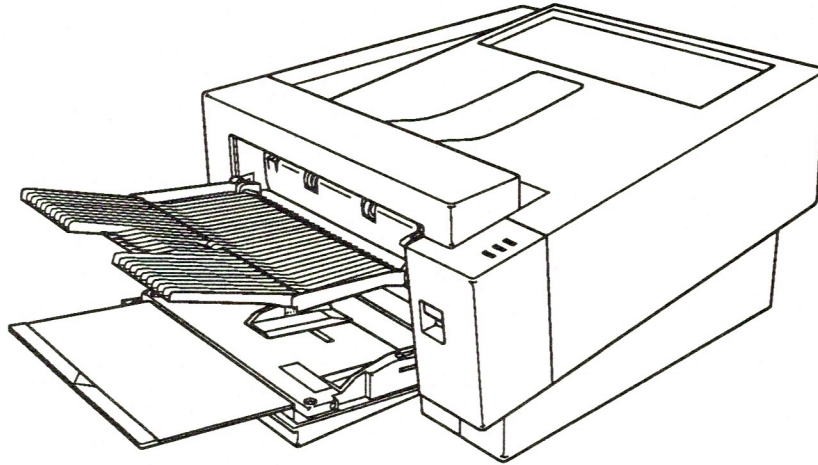
The Apple ImageWriter LQ is a wide carriage, impact dot matrix printer. It is compatible with all Apple II and Macintosh computers.

**LaserWriter II****Figure 33. LaserWriter II****Features:**

- Marking engine: Canon LBP-SX laser-xerographic
- Print resolution: 300 dots per inch
- Printing speed: Eight pages per minute
- Interface: LocalTalk, SCSI, RS-232, and RS-422
- Paper type: U.S. letter, U.S. legal, A4, B5, envelope cassettes
- Weight: 20.5 kg (45 lbs)

The Apple LaserWriter II, a family of laser-xerographic printers, includes the LaserWriter II NT, the LaserWriter II NTX, and the LaserWriter SC. The LaserWriter IINT and the LaserWriter IINTX are Postscript-based printers that connect to Apple II and Macintosh computers through the LocalTalk cable system. The LaserWriter SC is a QuickDraw-based printer that connects to Macintosh printers through the SCSI interface.

## Personal LaserWriter



**Figure 34. Personal LaserWriter**

### Features:

- Marking engine: Canon LBP-LX laser-xerographic
- Print resolution: 300 dots per inch
- Printing speed: Four pages per minute
- Paper type: Photocopy or typewriter bond, most letterhead and colored stock, medium-weight photocopier transparencies, labels, envelopes, U.S. letter, U.S. legal, A4, B5
- Weight: 14.5-15kg (31-32 lbs.)

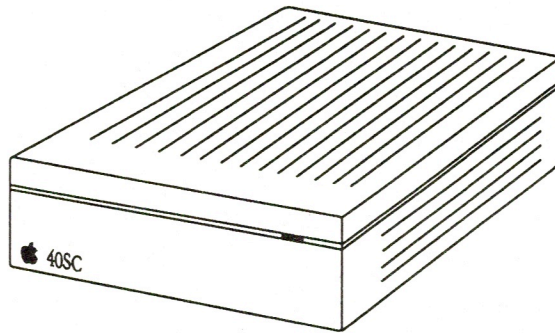
The Apple Personal LaserWriters are a family of printers that includes the Personal LaserWriter NT, LS and SC.

The Personal LaserWriter NT can operate in a network of both Macintosh and MS-DOS computers, due to its built-in LocalTalk networking capabilities. There are two ways to print on a Personal LaserWriter NT from an MS-DOS or OS/2-compatible computer: 1) by installing a LocalTalk PC card in the MS-DOS computer, and connecting the computer either directly to the printer, or into the printer's network, and 2) by directly connecting the computer via an RS-232-C port to the printer's RS 232-C port.

The Personal LaserWriter LS has a High-speed (909K) RS-422 serial interface. The Personal LaserWriter SC is designed for individual use and is connected to the Macintosh through the SCSI port.

Both the Personal LaserWriter NT and the LaserWriter SC are designed with an integral paper cassette which provides for automatic feeding of up to 250 sheets of paper. A second multipurpose tray can be used for letterhead, envelopes, labels, and card stock. With the Personal LaserWriter LS, the paper cassette is optional.

## Hard Disk SC

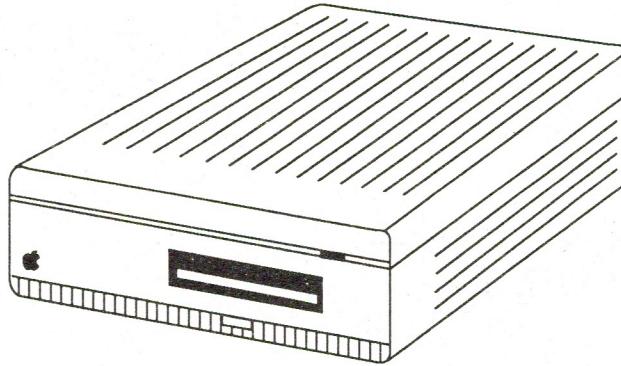


**Figure 35. Hard Disk SC**

### Features:

- Interface: Two 50-pin SCSI ports
- Formatted data capacity: 20, 40, 80, 160MB
- Data transfer rate: Up to 1.25MB per second
- Weight: 4 kg (9 lb.)

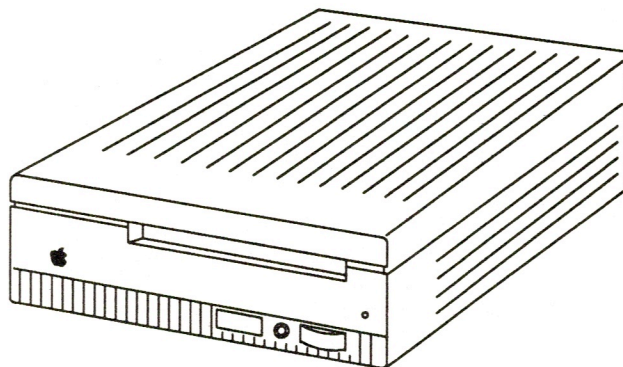
The Apple Hard Disk SC series of hard drives provide mass storage for all Macintosh and Apple II computers.

**Tape Backup 40SC****Figure 36. Tape Backup 40SC****Features:**

- Formatted data capacity: 38.5MB
- Data transfer rate: Up to 600 kilobits per second
- Tape speed: Up to 90 ips
- Rewind time: 27 seconds
- Interface: Two 50-pin SCSI connectors
- Weight: 3.3kg (7.3 lb.)

The Apple Tape Backup 40SC provides nearly 40MB of storage for Macintosh computers. Data is stored on industry standard DC2000 tape cartridges. With third-party software, the Apple Tape Backup 40SC can be used with Apple II computers that use SCSI.

## AppleCD SC



**Figure 37. AppleCD SC**

### Features:

- Data capacity: 656MB, 748MB
- Interface: Two 50-pin SCSI connectors
- Data transfer rate: 75 blocks per second
- Disk rotational speed: Up to 530 rpm
- Modes supported: CD-ROM, CD-Audio
- Weight: 4.0 kg (8.8 lbs.)

The AppleCD SC allows you to access Macintosh data and audio data from standard CD-ROM discs. CD-ROM discs store roughly 650MB of Macintosh data. With third-party software, the AppleCD SC can be used with Apple II computers that use SCSI.

**Compatibility**

Whenever possible, peripheral devices are designed to work with both Apple II and Macintosh computers. Many devices, however, work with only one or the other product family. The chart on the following page outlines exactly which peripheral devices will work with each Apple or Macintosh system. The major compatibility issues are summarized below:

- All Apple printers currently being manufactured will work with both Apple II and Macintosh computers.
- The mouse and keyboards for the Apple IIGS and all Macintosh computers except the Macintosh Plus are similar and interchangeable.
- The Apple 5.25 Drive and UniDisk 5.25 Drive work only with the Apple II computers.
- Apple II monitors work only with Apple II computers. Macintosh monitors work only with Macintosh computers.

	Alle	AIic	AIic+	AIIGs	M512	M512e	M+	MSE
<b>Keyboards</b>								
Apple Desktop Keyboard				•				•
Apple Extended Keyboard								•
Apple Desktop Mouse				•				•
<b>Monitors:</b>								
AppleColor RGB				•				
Apple Monochrome	•	•	•	•				
Apple Monochrome IIe	•	•	•	•				
AppleColor Composite	•	•	•	•		•		
AppleColor Composite IIe	•	•	•	•				
Macintosh 12" Monochrome								
Macintosh 12" RGB Display								
AppleColor High-Res. RGB								
Apple Two-Page Monochrome								
Apple Macintosh Portrait Display								
<b>Storage devices:</b>								
<i>Floppy drives</i>								
Apple 5.25 Drive	•	•	•	•				
Disk II	•			•				
DuoDisk	•		•	•				
Unidisk 5.25 Drive	•	•	•	•				
Unidisk 3.5 Drive	•	•	•	•				
Apple 3.5 Drive			•	•		•	•	•
SuperDrive								•
<i>Hard drives</i>								
HD20 SC	•			•			•	•
HD40 SC	•			•			•	•
HD80 SC	•			•			•	•
HD160 SC	•						•	•
Profile	•	•	•					
<i>Other</i>								
AppleCD SC	•			•			•	•
Apple Tape Backup 40SC							•	•
<b>Printers</b>								
ImageWriter	•	•	•	•	•	•	•	•
ImageWriter II	•	•	•	•	•	•	•	•
ImageWriter LQ	•	•	•	•	•	•	•	•
LaserWriter II	•			•	•	•	•	•
LaserWriter Plus	•			•	•	•	•	•
Personal LaserWriter NT	•	•	•	•				
Personal LaserWriter LS					•	•	•	•
Personal LaserWriter SC					•	•	•	•
<b>Other</b>								
Apple Scanner							•	•
Apple Personal Modem	•	•	•	•	•	•	•	•

A = Apple M = Macintosh

Table 1: Compatibility Chart (page 1)

	MSE/30	Classic	MII	MIIX	MIIfx	MIICx	MIICI	MIISI	MLC	MPortable
<b>Keyboards</b>										
Apple Desktop Keyboard	•	•	•	•	•	•	•	•	•	•
Apple Extended Keyboard	•	•	•	•	•	•	•	•	•	•
Apple Desktop Mouse	•	•	•	•	•	•	•	•	•	•
<b>Monitors:</b>										
AppleColor RGB										
Apple Monochrome										
Apple Monochrome IIe										
AppleColor Composite										
AppleColor Composite IIe										
Macintosh 12" Monochrome			•	•	•	•	•	•	•	
Macintosh 12" RGB Display			•	•	•	•	•	•	•	
AppleColor High-Res. RGB			•	•	•	•	•	•	•	
Apple Two-Page Monochrome					•	•	•	•		
Apple Macintosh Portrait Display			•	•	•	•	•	•		
<b>Storage devices:</b>										
<i>Floppy drives</i>										
Apple 5.25 Drive										
Disk II										
DuoDisk										
Unidisk 5.25										
Unidisk 3.5										
Apple 3.5 Drive	•	•					•	•	•	
SuperDrive (1.44MB)	•	•	•	•		•	•	•	•	•
<i>Hard drives</i>										
HD 20SC	•	•	•	•	•	•	•	•	•	•
HD 40SC	•	•	•	•	•	•	•	•	•	•
HD 80SC	•	•	•	•	•	•	•	•	•	•
HD 160SC	•	•	•	•	•	•	•	•	•	•
Profile										
<i>Other</i>										
AppleCD SC	•	•	•	•	•	•	•	•	•	•
Apple Tape Backup 40SC	•	•	•	•	•	•	•	•	•	•
<b>Printers</b>										
ImageWriter	•	•	•	•	•	•	•	•	•	•
ImageWriter II & II/L	•	•	•	•	•	•	•	•	•	•
ImageWriter LQ	•	•	•	•	•	•	•	•	•	•
LaserWriter II	•	•	•	•	•	•	•	•	•	•
LaserWriter Plus	•	•	•	•	•	•	•	•	•	•
Personal LaserWriter NT										
Personal LaserWriter LS	•	•	•	•	•	•	•	•	•	•
Personal LaserWriter SC	•	•	•	•	•	•	•	•	•	•
<b>Other</b>										
Apple Scanner	•	•	•	•	•	•	•	•	•	•
Apple Data Modem 2400	•	•	•	•	•	•	•	•	•	•

A = Apple M = Macintosh

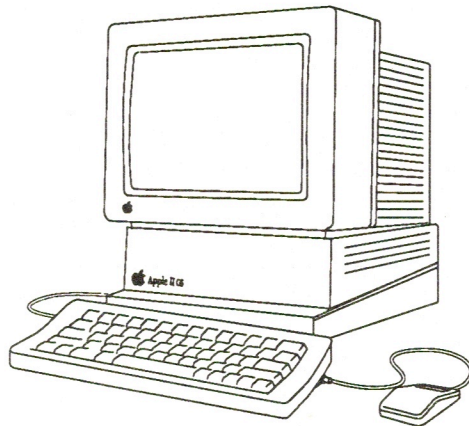
Table 2: Compatibility Chart (page 2)

Continue with the next section, Exercise: Identifying Apple Products.

# Exercise: Identifying Apple Products

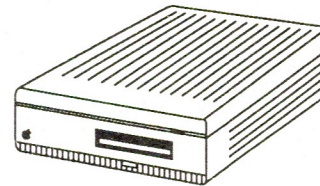
## Directions

Identify the Apple products represented below. Check the correct answer.



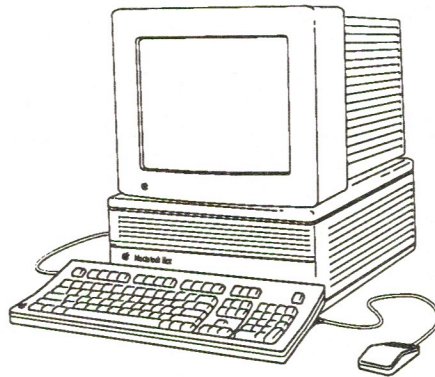
1.

- ☐ A. Macintosh IIx
- ☐ B. LaserWriter IINT
- ☒ C. Apple IIGS
- ☐ D. Apple IIc Plus



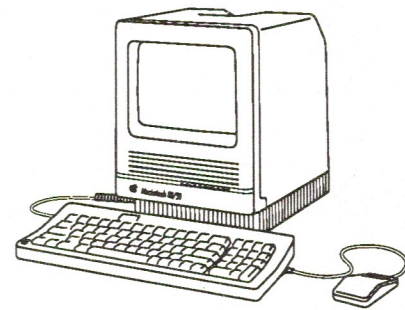
2.

- ☐ A. Macintosh SE/30
- ☒ B. Tape Backup 40SC
- ☐ C. Apple IIe
- ☐ D. ImageWriter LQ



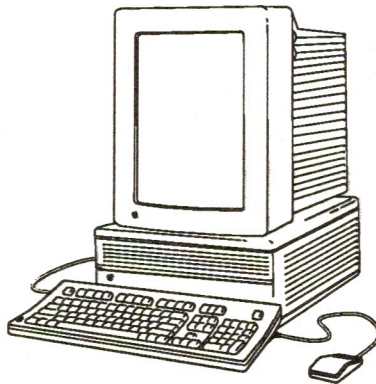
3.

- ☒ A. Macintosh IIcx
- ☐ B. Apple CD SC
- ☐ C. Macintosh LC
- ☐ D. Macintosh SE



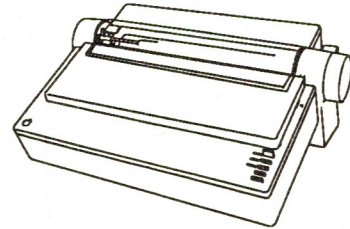
4.

- ☐ A. Apple IIGS
- ☐ B. ImageWriter II
- ☐ C. Macintosh IIsi
- ☒ D. Macintosh SE/30



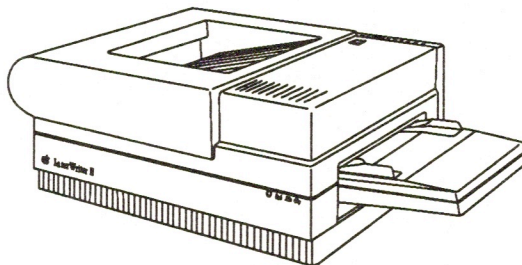
5.

- ☒ A. Macintosh Plus
- ☐ B. Macintosh IIci
- ☐ C. Apple IIc
- ☐ D. Apple IIe



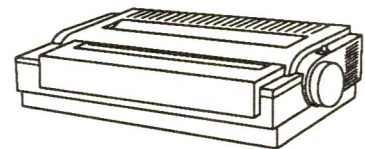
6.

- ☐ A. Macintosh SE/30
- ☐ B. Tape Backup 40SC
- ☐ C. LaserWriter IINT
- ☒ D. ImageWriter II



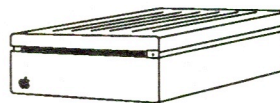
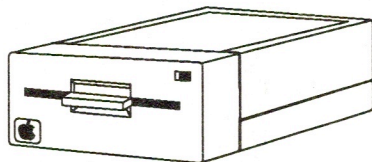
7.

- ☐ A. Tape Backup 40SC
- ☒ B. LaserWriter IINT
- ☐ C. Apple IIGS
- ☐ D. Personal LaserWriter NT



8.

- ☐ A. ImageWriter II
- ☐ B. AppleCD SC
- ☐ C. Hard Disk 40SC
- ☒ D. ImageWriter LQ

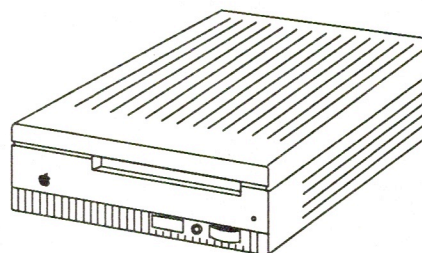
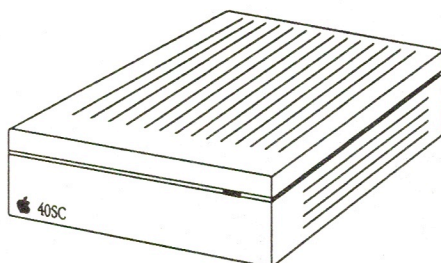


9.

- ☐ A. Macintosh IIx
- ☐ B. Apple 3.5 Drive
- ☒ C. Apple 5.25 Drive
- ☐ D. Apple Scanner

10.

- ☐ A. ImageWriter II
- ☐ B. Tape Backup 40SC
- ☒ C. Apple 3.5 Drive
- ☐ D. Apple IIc Plus

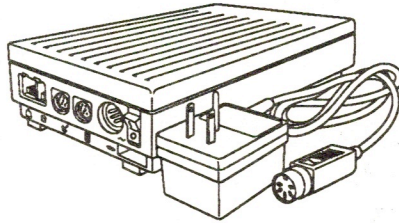


11.

- ☒ A. Hard Disk 40SC
- ☐ B. Personal LaserWriter LS
- ☐ C. Apple IIe
- ☐ D. ImageWriter LQ

12.

- ☐ A. Macintosh SE/30
- ☐ B. Apple IIGS
- ☒ C. Apple CD SC
- ☐ D. Apple 5.25 Drive



13.

- ☐ A. Apple IIe
- ☐ B. Tape Backup 40SC
- ☐ C. Apple IIGS
- ☒ D. Data Modem 2400

14.

- ☒ A. Apple Scanner
- ☐ B. Apple 3.5 Drive
- ☐ C. Apple IIe
- ☐ D. LaserWriter IINT

Check your answers with those on the next page.

---

## Exercise: Identifying Apple Products (Answers)

### Apple Products

1. C - Apple IIGs
2. B - Tape Backup 40SC
3. D - Macintosh SE/30
4. A - Macintosh IICx
5. B - Macintosh IIfx
6. D - ImageWriter II
7. B - LaserWriter II<sup>nr</sup>
8. D - ImageWriter LQ
9. C - Apple 5.25 Drive
10. C - Apple 3.5 Drive
11. A - Hard Disk 40SC
12. C - AppleCD SC
13. D - Data Modem 2400
14. A - Apple Scanner

Continue with the next section, **Apple Repair Strategy**.

---

# Apple Repair Strategy

## Introduction

This section explains the Apple repair strategy, how Apple products are designed for fast and easy repair, and the major steps for exchanging faulty parts. At the end of this section, you will have an overview of the repair process and your role in it.

## Apple's Repair Philosophy

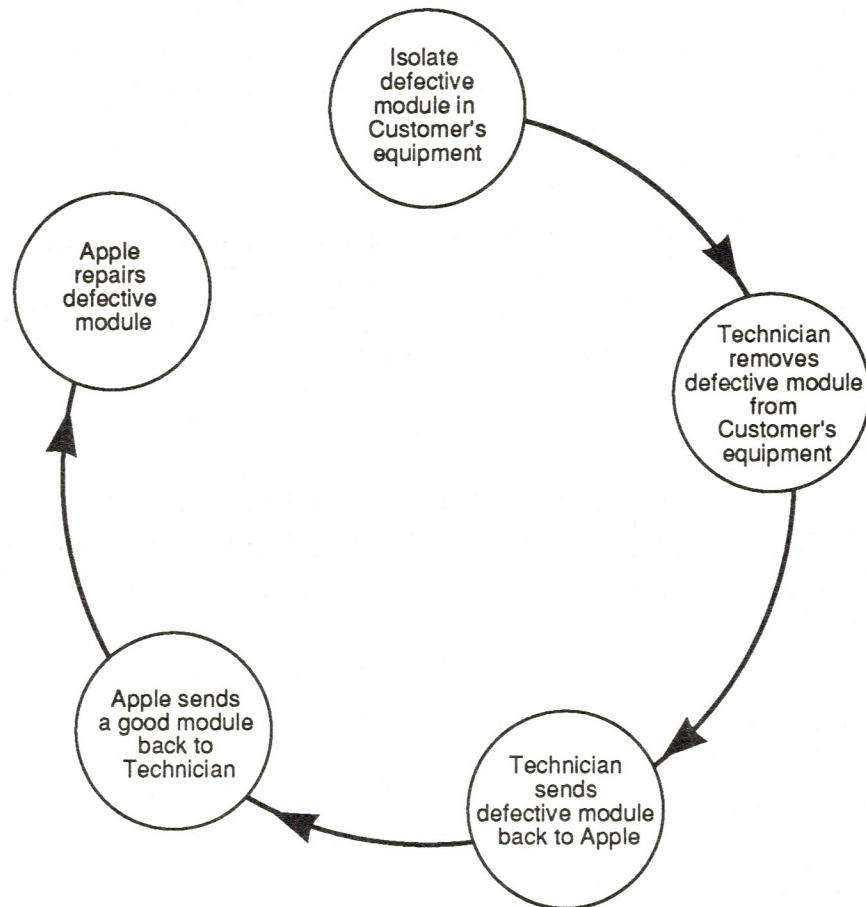
The concept behind the Apple repair strategy is simple:

**Provide the customer the best quality service at the cheapest price in the shortest time possible.**

This means:

- Designing products that are easy to service
- Automating the repair process to save time and labor costs

## Modular Design



**Figure 38. The Apple repair cycle**

Apple products are built from replaceable **modules**. If they fail, modules can be removed quickly and easily. Many modules are designed to snap into place. Usually you can remove or install one without using a screwdriver or other tools.

## Repair Process

Apple Service Technicians diagnose and repair a product to the module level. Faulty modules are isolated and then repaired to the component level using an automated process at Apple's repair facility. The main steps of the repair process are shown in Figure 38 and outlined as follows:

**Step 1: Fault Isolation**

The Service Technician first isolates the problem to the module level. For example, the problem in the power supply. The faulty module (the power supply) is then removed. There is no need to isolate the faulty component within the module.

**Step 2: Module Swap**

The faulty module is replaced as a single unit from the technician's supply of spare modules.

**Step 3: Shipping**

A Service Repair Order is completed (using the AppleOrder system, the ABCD Warranty Reimbursement Form, or the SRO Form), requesting either a new or repaired module replacement. The entire module is then shipped to the Apple repair facility.

**Step 4: Resupply**

New or reworked modules are sent back to the technician to replace the ones used in the module swap. If the service location is using the AppleOrder system, the time savings is considerable.

By keeping a stock of modules on hand, technicians can accomplish speedy repairs at minimal cost to the customer.

**Step 5: Repair**

At the Apple repair facility, automated test equipment diagnoses and repairs modules in a fraction of the time it would take a single technician. The repaired module is placed in Apple's store of reworked modules. These modules must meet new product quality standards.

**Component Level Repair**

Service Technicians occasionally perform component-level repairs on some Apple products. These are cases in which the:

- Unit is no longer under warranty, and
- Faulty component is one of the few designed to be easily replaced, such as a battery or a nonsoldered ROM chip

Under those conditions it is more cost-effective to isolate and replace individual components instead of an entire module.

**Continue with the next section, Your Role: Service and Support.**

---

# Your Role: Service and Support

## Introduction

The automation of the repair process has changed the role of the Apple Service Technician. Technicians spend less time repairing individual components and more time providing a broad range of technical support to Apple customers. In many ways technicians act as Apple representatives when working with customers.

The responsibilities of Apple Service Technicians fall into two broad categories: **Technical Service** and **Customer Support**.

## Technical Service

All Apple Service Technicians must be able to:

- Identify each Apple product and describe its main function
- Diagnose and repair each Apple product to the module level
- Access technical information as needed from the Apple publications, AppleLink libraries, and appropriate Apple personnel
- Set up and configure Apple personal computer systems

## Customer Support

In addition, Service Technicians are expected to:

- Perform hardware and software upgrades
- Enforce Apple warranties and service policies
- Provide customer support both in person and over the phone
- Interact with customers in a professional manner

Service Technicians are often the only contact a customer has with Apple after making a purchase. How a technician interacts with a customer can have a direct bearing on Apple's public image as well as the technician's own service department. Apple Service Technicians are expected to handle all problems, including problematic customers, in a professional manner.

### **Apple's Role**

Apple supports Service Technicians with a variety of resources, including training, procedural manuals, the AppleLink communication and information network, and support personnel. The next section looks at the Apple support structure and how Service Technicians work with it.

**Continue on to the next section, Working with Apple: Service and Support**

---

# Working with Apple: Service and Support

## Introduction

The key to providing efficient service and technical support to your customers is understanding how to access information and get assistance from Apple. For example, you need to know where to get your technical questions answered quickly, how to order spare parts, where to get training on newly released products, and whom to contact when an account is having trouble. Through its support staff, AppleLink communications network, training, and reference materials, Apple can provide assistance with virtually any service or technical problem.

## AppleLink

AppleLink, Apple's communication and information network, is the cornerstone of Apple's support structure. AppleLink allows Apple employees, resellers, and technicians to communicate through an electronic mail system via computer and modem. AppleLink also provides its users access to large databases of technical and service information (called libraries and bulletin boards).

Much of the support Apple provides service technicians comes through AppleLink. *Therefore, all Apple Service Technicians must use the AppleLink system.* You will learn how to use AppleLink during the lab part of this course.

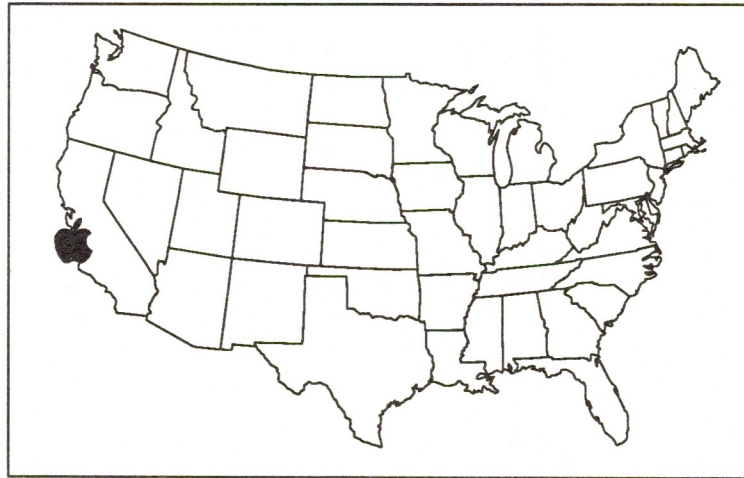
## Four Kinds of Support

Most problems facing service technicians can be grouped into four categories: Technical, Administrative, Training, and Service. Apple provides a support group for each type of problem.

### 1. Technical Support

You can obtain technical information from three main sources:

- Apple publications, such as the Technical Procedures
- AppleLink libraries and bulletin boards
- Apple Technical Operations staff in Campbell, California



**Figure 39. Apple Technical Support location**

The *Apple Service Technical Procedures* manuals contain information for troubleshooting, adjusting, and taking apart Apple products. In most cases the Technical Procedures are all you will need to make a repair.

**Note:** A comprehensive survey of Apple reference materials for service technicians will be presented later. You will use these materials in the lab part of this course.

Technical information not contained (or not easily accessed) in the Technical Procedures can be obtained by searching the relevant AppleLink databases.

If searching Apple Technical publications and AppleLink libraries and bulletin boards fails to produce an answer, you can use AppleLink to send your questions directly to an Apple Technical Operations staff member.

If you have an unusual or pressing problem, you can call Apple Technical Operations and talk directly to a staff member.

### Escalation Path

The search for technical information should always follow these steps:

1. Search the print references available on site, such as the Technical Procedures.
2. Search the AppleLink libraries and bulletin boards.
3. Send your technical questions via AppleLink to the Technical Operations staff.
4. Contact the Technical Operations staff directly by phone.

(Directions for contacting the support site are contained in the *Apple Service Programs* manual.)

### 2. Administrative Support

You will need administrative support to obtain spare modules and parts, and to get answers to policy questions, such as Apple warranty validation, reporting procedures for warranty reimbursement, AppleCare, status of Service Repair Orders, and so on.

Administrative support is provided in three ways:

- The *Apple Service Programs* manual outlines Apple's policies for warranty repairs and reimbursements, administrative procedures such as the Service Repair Order, and pricing information.
- Service libraries and bulletin boards on AppleLink contain current Service and Support notices, AppleCare information, and other service-related articles.
- Customer Service Administration staff can be contacted by AppleLink or by telephone.

**Escalation Path**

When you need information concerning administrative policy or procedure, follow these steps:

1. Begin with the *Apple Service Programs* manual.
2. Search the relevant AppleLink libraries or bulletin boards.
3. Contact Customer Service Administration.

**3. Training Support**

Technical and service training includes self-paced and interactive "home-study" courses as well as in-class hands-on instruction. In-class training, such as the second portion of this course, is held in the following locations:

- San Jose, CA
- Culver City, CA
- Chicago, IL
- Marlboro, MA
- Charlotte, NC
- Dallas, TX

Information on training is available from three sources:

- The *Apple Service Programs* manual
- AppleLink bulletin boards
- Field Training Coordinators (by phone or AppleLink)

**4. Service Support**

From time to time, problems require special treatment. For example, if technicians notice a trend developing with defective modules, they should alert the Customer Support Account Manager. The Customer Support Account Manager will either handle the problem directly or else get assistance from the appropriate manager within the Apple Service Organization.

### Field Support Organization

The Field Support Organization can sometimes play an important role in providing support to the Service Technician. Although most of your contact with Field Support will be through your Customer Support Account Manager, it is helpful to understand who the principal managers are and how they can help.

#### **OCSM**

The Operations Customer Satisfaction Manager is responsible for territory-wide service, support and training.

#### **GCSAM**

The Group Customer Support Account Manager manages the CSAMs and CREs.

#### **CSAM**

**The Customer Support Account Manager** ensures the effective implementation of Customer Satisfaction programs in a region. The CSAM is responsible for ensuring that third-party providers are capable, and works with accounts, dealers and agents to develop support plans. Works with appropriate field and corporate organizations to ensure that major customer problems are escalated and resolved successfully.

#### **CRE**

**The Customer Response Engineer** ensures continued capability of service providers, and participates in the escalation process when it is required for on-site troubleshooting.

**Note:** *Apple's organizational structure is dynamic; job titles are sometimes changed and responsibilities reassigned. New positions are created and old ones removed. In general, however, the positions and functions described here will remain relatively constant.*

**Continue with the Module Summary.**

---

# Module Summary

## Introduction

This module introduced you to Apple products and gave you an overview of the Apple repair process. You learned how Apple products are designed for easy repair and the kind of support Apple provides Service Technicians. You also learned the basic things each technician is expected to do.

## Apple Products

There are four main product lines or families:

- Modular Apple II systems
- Compact Macintosh systems
- Modular Macintosh systems
- Portable Macintosh

The compact design features built-in drives, power source, and monitors. The Apple II and Macintosh modular design have detached monitors and expansion slots. The portable design runs on a battery and has built-in display, drives, and keyboards.

Peripheral devices, such as printers and disk drives, are designed to work with as many Apple II and Macintosh computers as possible. However, some peripheral devices, such as monitors, work only with either Apple II or Macintosh computers.

## Compatibility

The following guidelines are useful for determining product compatibility.

- All Apple printers currently being manufactured will work with both Apple II and Macintosh computers.
- The mouse and keyboards for the Apple IIGS and all Macintosh computers (except the Macintosh Plus) are similar and can be used interchangeably.
- Apple 5.25 Drives, except the PC 5.25-inch drive, work only with the Apple II computers and Macintosh computers.
- Apple II monitors work only with Apple II computers. Macintosh monitors work only with Macintosh computers.
- The compatibility chart included in this module indicates exactly which Apple products work with a given Apple computer.

### Repair Process

Apple aims to provide the customer with the fastest, highest quality service for the cheapest price.

Apple products are made up of separate modules, such as the power supply or the circuit board. The repair process followed by Apple Service Technicians is to:

- Isolate the problem to the module level.
- Replace faulty modules as a single unit from a supply of new or reworked modules purchased from Apple.
- Complete administrative work (using the AppleOrder system, the ABCD Form, or the SRO Form) requesting either a new or repaired module replacement, then ship the faulty module to an Apple repair facility.
- Receive new or reworked modules from the Apple repair facility.

### *Technician's Role*

The responsibilities of Service Technicians fall into two broad categories: technical service and customer support.

All Apple Service Technicians must be able to:

- Identify each Apple product
- Diagnose and repair, to the modular level, each Apple product
- Access technical information as needed from the Technical Procedures manuals, AppleLink libraries, and appropriate Apple personnel
- Set up and configure customers' computers

In addition, technicians are expected to:

- Perform hardware and software upgrades for customers
- Enforce Apple warranties and service policies
- Provide technical support to customers

Apple Service Technicians are expected to handle all problems and problematic customers in an evenhanded and professional manner.

**Apple Service and Support Organization**

- Supports technicians with a variety of resources, including training, procedural manuals, technical support, and customer service personnel
- Supports technicians through the AppleLink communications, information network and Apple Technical Operations
- Provides support to its technicians and customers in four main areas: Technical, Administrative, Training, and Special

***Technical Support***

Provides technical support through:

- Apple publications, such as the Technical Procedures
- AppleLink libraries and bulletin boards
- Apple Technical Operations staff in Campbell, California

***Administrative Support***

- Assists you in obtaining spare modules and parts
- Provides answers to policy questions, such as Apple warranty validation, reporting procedures for warranty reimbursement, AppleCare, and so on

***Training Support***

- Provides technical and service training, which includes self-paced and interactive "home-study" courses, as well as in-class hands-on instruction
- Provides in-class training, such as the lab part of this course, held at regional Apple Training Centers

***Service Support***

- Addresses problems that require special treatment, such as those which can't be solved through Apple Technical Operations
- Provides a Customer Support Account Manager to either handle the problem directly or get assistance from the appropriate manager in the Field Support Organization

### Seeking Assistance: The Escalation Path

When looking for assistance on a technical or administrative problem, or when looking for information regarding training, service technicians *normally* follow this path:

1. Consult the reference materials, such as the Technical Procedures or the *Apple Service Programs* manual that you have on hand.
2. Search the AppleLink libraries or bulletin boards, if you can't find the needed information in the references.
3. Contact the appropriate staff either by phone or by AppleLink. (Directions on how to do this are given in the *Apple Service Programs* manual.)

Following this procedure ensures the efficient use of the resources provided to Service Technicians.

### Customer Service Organization

Customer Support Account Managers provide critical support service to technicians by:

- Ensuring that dealers comply with Apple service standards and that Service Technicians are trained and certified
- Handling important accounts that are experiencing significant technical problems
- Handling larger policy questions

**Continue with the Module Test.**

# Module Test

## Directions

For each of the following problems, indicate where you would look for assistance in the Apple Support structure. Fill in the blanks with the corresponding letter or letters.

- A. Customer Service Administration
- B. Service Training
- C. Technical Operations
- D. Customer Support Account Manager
- E. AppleLink libraries and bulletin boards
- F. Technical Procedures and *Apple Service Programs* manuals

1. A, E You need to order a part.
2. D A customer claims that five new Macintosh SEs he has just purchased are defective with the same problem.
3. B, E, F You want to learn how to repair a new product.
4. C You want to review the current Service and Support notices.
5. F The first place you look when you have a question about a technical procedure.
6. F, C You have a technical question that isn't covered in the Technical Procedures manuals.

For each of the following questions, check the letter that corresponds to the correct answer.

7. As an Apple Service Technician, you will be expected to do all of the following **except**:

- ☐ A. Identify each Apple product.
- ☐ B. Set-up and configure customer's computers.
- ☒ C. Build automated test equipment.
- ☐ D. Obtain information needed to complete a repair from AppleLink or support personnel.

8. Apple Service Technicians act as representatives of Apple by:

- ☐ A. Performing hardware and software upgrades for customers.
- ☐ B. Enforcing Apple policies and warranties.
- ☐ C. Responding to customer problems and complaints in a professional manner.
- ☒ D. All of the above.

9. The Apple repair strategy aims to get the customer's equipment up and running as fast as possible. To this end, Apple products are designed so that:

- ☒ A. Entire modules may be removed easily and replaced quickly .
- ☐ B. Individual components can be tested easily.
- ☐ C. Peripherals will work only with Apple II computers or only with Macintosh computers.
- ☐ D. Customers won't notice when something is wrong.

10. In its overall design strategy of peripheral devices, Apple attempts to :

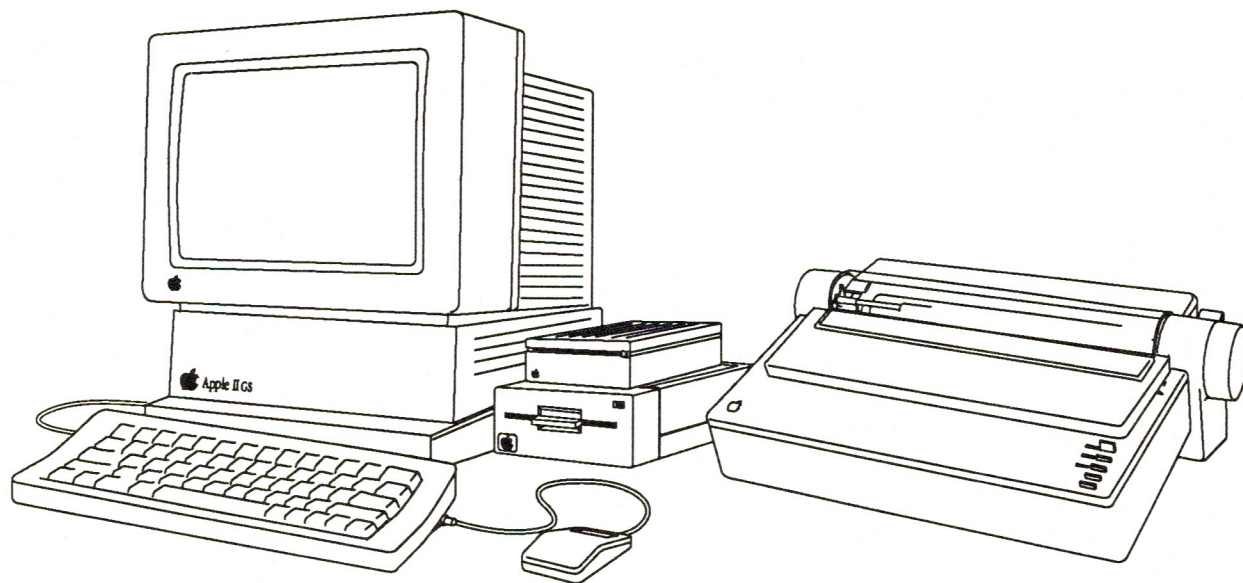
- ☐ A. Make peripherals work only with Apple II or only with Macintosh computers whenever possible.
- ☒ B. Make each peripheral work with both the Macintosh and the Apple II computers whenever possible.
- ☐ C. Make peripherals with no moving parts.
- ☐ D. Both B and C.

**Continue with the Module Test on the next page.**

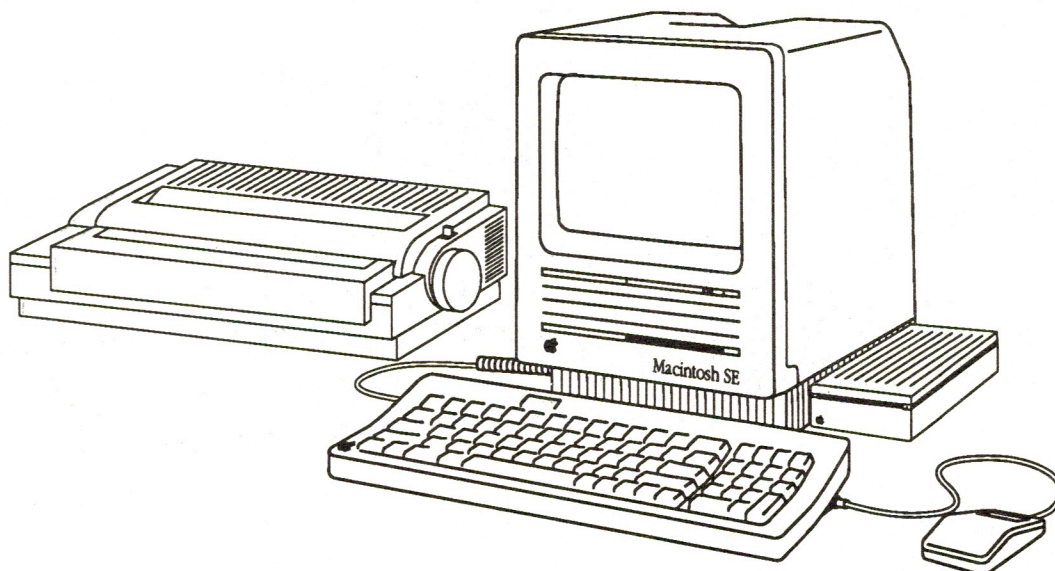
**Directions**

11. For the following items, identify the products illustrated in each item. In the spaces provided, write in the letters corresponding to the product names listed below.

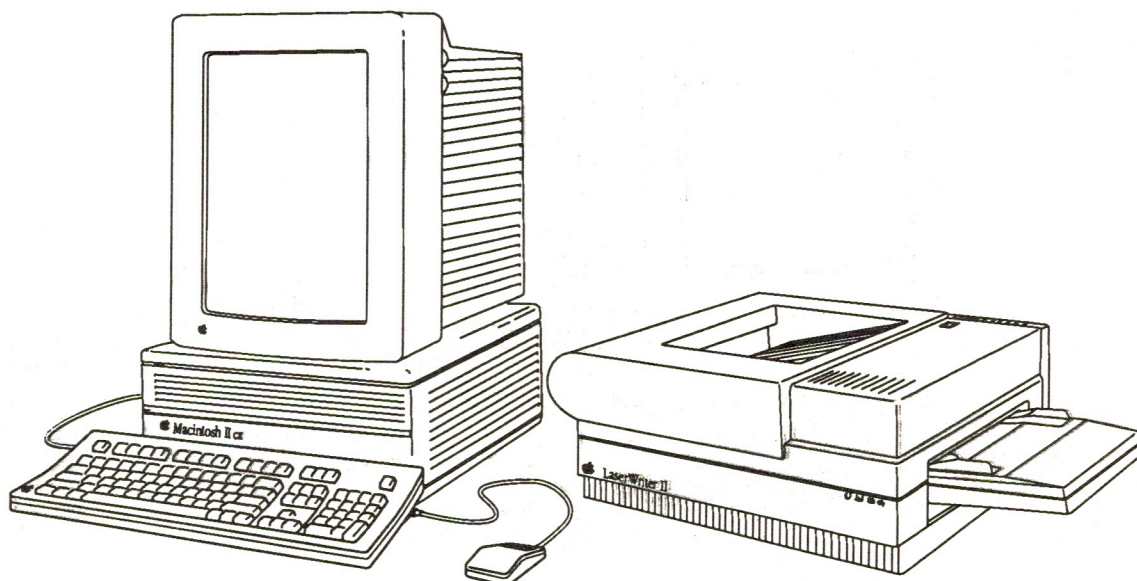
- A Apple IIGS computer
- B Macintosh IIfx computer
- C Macintosh SE
- D MacintoshClassic
- E Macintosh IIsi
- F LaserWriter II<sub>nr</sub>
- G ImageWriter II
- H ImageWriter LQ
- I Apple 3.5 Drive
- J Apple 5.25 Drive
- K Apple Hard Disk 80SC
- L Apple Scanner



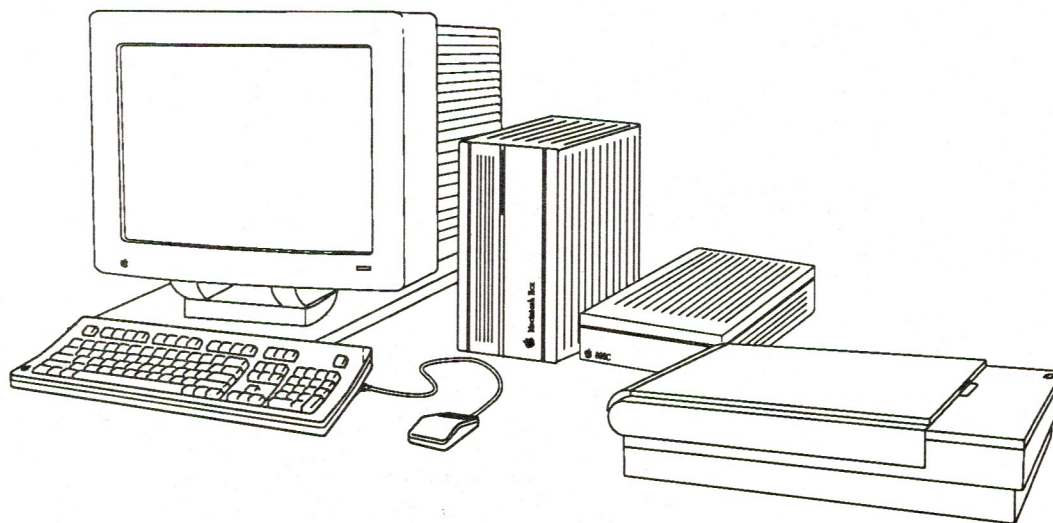
a. A I J G



b. H C I



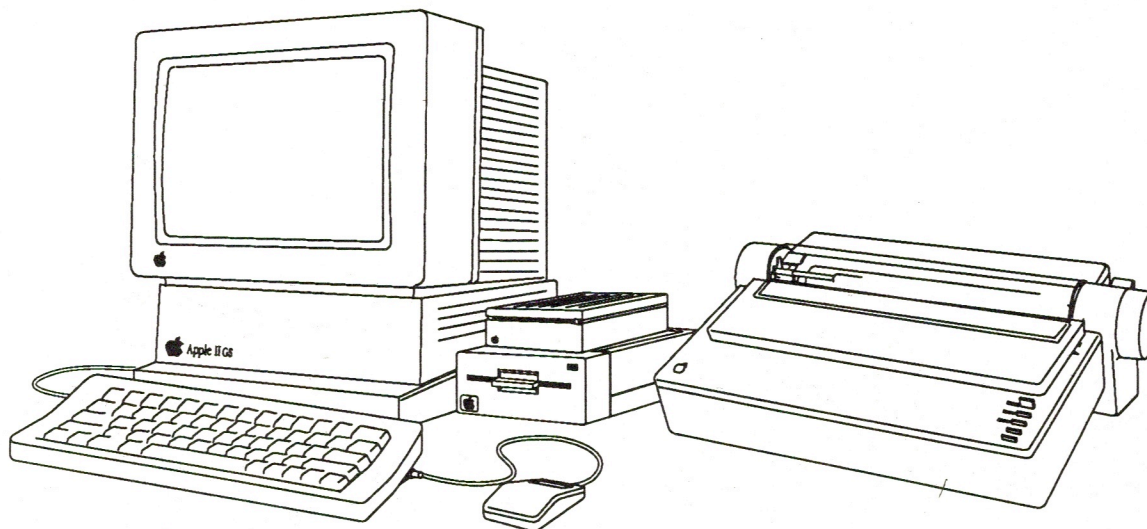
c. B F



d. B K L

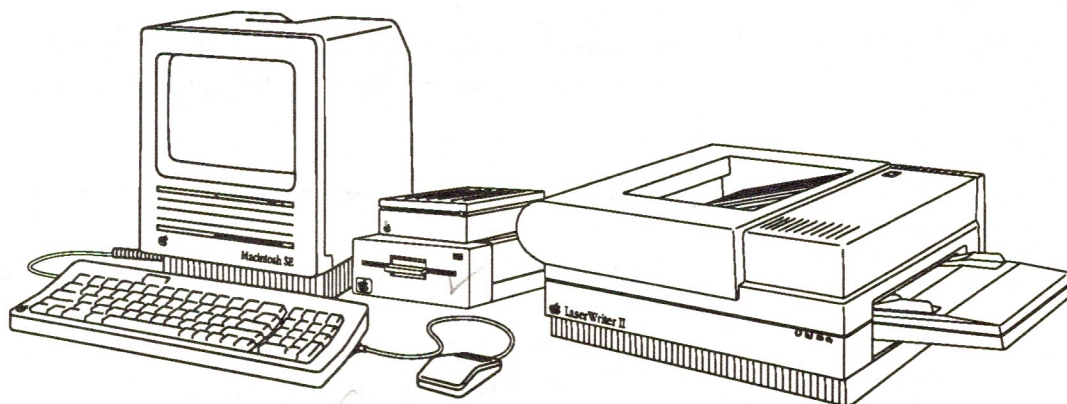
**Directions**

12. For each of the following configured systems, check whether the peripheral devices are compatible or incompatible with the computer. Then draw an "X" on each component that is incompatible.



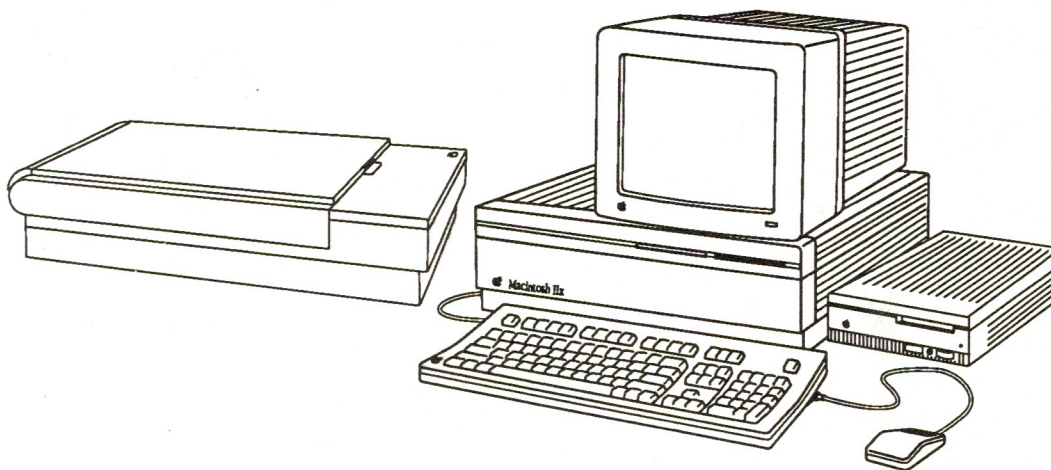
a.

☒ Compatible  
☐ Incompatible



b.

- ☐ Compatible  
☒ Incompatible



c.

- ☒ Compatible  
☐ Incompatible

**Directions**

13. When faced with a repair problem that requires technical information, *normally* the service technician does what first? Check the correct answer.

- ☐ A. Contacts the Apple Technical Operations staff through AppleLink.
- ☐ B. Contacts the Apple Technical Operations staff by phone.
- ☒ C. Looks for the information in an Apple reference publication, such as the Technical Procedures manuals.
- ☐ D. Searches the AppleLink bulletin boards for special announcements.

**Compare your answers with those on the following page.**

# Module Test (Answers)

## Directions

1. A and E
2. D
3. B, E, and F
4. D
5. F
6. E or C (The usual path is to check AppleLink libraries first, then contact Apple Technical Operations with a specific question.)
7. C (Apple repairs are accomplished by module swaps. Defective modules are repaired at special repair facilities.)
8. D
9. A
10. B
11.
  - A Apple IIgs computer
  - B Macintosh IICx computer
  - C Macintosh SE
  - D Macintosh Classic
  - E Macintosh IIsi
  - F LaserWriter II<sub>nx</sub>
  - G ImageWriter II
  - H ImageWriter LQ
  - I Apple 3.5 Drive
  - J Apple 5.25 Drive
  - K Apple Hard Disk 80SC
  - L Apple Scanner
- a. A, G, I, J
- b. C, H, I
- c. B, F
- d. B, K, L

- 12. a. Compatible  
b. Incompatible—5.25 Drive  
c. Compatible
  
- 13. C (*Normally* you will check Apple publications for information first.)

You have completed this module. Check the Skills Checklist to verify that you have acquired the skills and knowledge listed there.

**Now continue with the next module.**

---

# ESD Module

## Table of Contents

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# Module Introduction

## Overview

Electrostatic discharge (ESD) is a major cause of damage to integrated circuits (ICs) and circuit boards. What causes ESD? How serious is this damage? What can you do to avoid it?

## What You Will Learn

When you have finished module, you will:

- Know what you should do to prevent ESD damage
- Be able to set up an ESD-safe workstation
- Use equipment and materials designed to prevent ESD damage

The Skills Checklist following this Module Introduction lists in detail the tasks you will learn in this module.

## How You Will Be Tested

**Module Test** This written test will help you check your understanding of the material presented in the module.

**Prerequisite Exam** This test, consisting of written and hands-on parts, will verify that you understand the risks of ESD and know the ESD prevention rules.

**Hands-on Exercises** Throughout the lab part of this course, the Course Manager will observe your behavior to verify that you follow all ESD prevention rules. **To pass this course, you must exhibit ESD-safe behavior.**

## Prerequisites to the Module

Before you begin this module, you must have completed the Welcome to Apple Service module.

## Materials Provided for this Module

The Prerequisite provides the following items for this module:

- This Module Workbook
- Videotape entitled *The Shocking Truth*
- Module Test

### Materials You Need to Provide

Completing this module requires that you set up an ESD-safe workstation. For that exercise, you will need to provide the following materials:

- Conductive workbench mat with ground cord
- Wrist strap, with a built-in 1-megohm resistor and ground cord
- Equipment ground cord, with alligator clips
- Ground/polarity tester

If you don't already have these materials, you can buy them at most electronics shops.

### How this Module Is Organized

This module is presented in two parts:

**Part 1: ESD Prevention** The videotape *The Shocking Truth* explains what ESD is, how it causes damage, and what can be done to prevent the damage. The prevention rules are further explained in this module.

**Part 2: An ESD-Safe Work Area** This part explains the equipment that you should use to prevent ESD damage, and provide directions for setting up and using an ESD-safe workstation.

Following these two parts is a Module Summary.

**Continue with the Skills Checklist on the following pages.**

---

# Skills Checklist

## **What Is the Skills Checklist?**

This is a list of tasks that you should be able to perform at the conclusion of this module. The Prerequisite Exam will cover these items.

## **How to Use the Checklist**

Before starting the module, you should check the items on this list. If you are confident that you can already perform certain tasks, you may decide to skip those parts of the module. Or you may decide to try the Module Test without going through the module.

After completing the module, you should check this list to make certain that you have mastered all the skills before you attend the Prerequisite Exam and lab part of this course. If you feel uncertain about any of these tasks, you should return to the section indicated, review the information, and repeat the hands-on exercises.

Task	Where the Task is Covered
___1. Explain in general terms what ESD is and how it causes damage.	<i>The Shocking Truth</i> videotape
___2. State the seven ESD prevention rules.	Preventing ESD
___3. Describe ways that you can inform other people about the risks of ESD.	Preventing ESD
___4. List the minimal equipment that you must use at your workstation to reduce the ESD risk.	<i>The Shocking Truth</i> videotape Equipment for Preventing ESD
___5. Explain (in general terms) what each piece of ESD preventative equipment does to reduce the ESD risk.	<i>The Shocking Truth</i> videotape Equipment for Preventing ESD
___6. Remove all ESD hazards from your work area.	<i>The Shocking Truth</i> videotape Setting Up an ESD-Safe Workstation
___7. Set up a conductive workbench mat.	<i>The Shocking Truth</i> videotape Setting Up an ESD-Safe Workstation
___8. Provide adequate grounding for your work area.	<i>The Shocking Truth</i> videotape Setting Up an ESD-Safe Workstation
___9. Put on a wrist strap properly and wear it at appropriate times.	<i>The Shocking Truth</i> videotape Setting Up an ESD-Safe Workstation
___10. Explain ESD preventative steps to be taken when working at a customer's site.	<i>The Shocking Truth</i> videotape Setting Up an ESD-Safe Workstation

Continue with the next section, Preventing ESD.

# Preventing ESD

View the videotape The Shocking Truth. Then continue with this section.

## The Shocking Truth

The videotape The Shocking Truth explains what ESD (electrostatic discharge) is, why it is a serious problem, and what you can do to reduce ESD damage. The rest of this section presents basic rules for preventing ESD damage and suggests ways to inform other people about the dangers of ESD.

## ESD Prevention Rules

You are expected to learn the following seven rules and to apply them whenever you work on Apple equipment. To help you remember them, we have provided a key word for each rule.

### **Grounds**



Before working on any device containing a printed circuit, ground yourself and your equipment to an earth or building ground.

Use a grounded conductive workbench mat and a grounding wrist strap, and ground your equipment to the mat.

**Warning:** Do not ground yourself when working on "live" (plugged in) equipment or when discharging a cathode-ray tube (CRT).

### **Bodies**



Don't touch anybody who is working on integrated circuits.

If that person is properly grounded, your "zap" may not cause any damage, but just to be on the safe side, keep your own body charge away from other technicians.

### **Bags**



Use static-shielding bags for boards and ICs during storage, transportation, and handling.

Before you leave your bench to take a board to a storage place, put the board in a static-shielding bag. Leave all Apple service exchange components in their ESD-safe packaging until needed.

### *Pins*



Handle all ICs by the body, not by the pins.

Also, do not touch PCB edge connectors, exposed circuitry, or printed circuits. Handle ICs and PCBs by the edges, or use extractors.

### *Synthetics*



Do not wear polyester clothing or bring plastic, vinyl, or Styrofoam into the work environment.

The electrostatic field that surrounds these nonconductors cannot be totally removed.

### *Metals*



Never place components on any metal surface.

Use antistatic or conductive mats or foam.

### *Atmosphere*



If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.



Charge levels are reduced (but not eliminated) in high-humidity environments. Using an ion generator neutralizes the charge surrounding nonconductors. However, this type of device can't provide total protection because the static charges often cause ESD damage before the neutralizing process eliminates the charge.

Below is a table summarizing the seven prevention rules.

Summary of ESD Prevention Rules		
	ESD Safe	ESD Unsafe
<b>Grounds</b>	Earth ground, floor mats, table mats, wrist straps	Grounded while working with live equipment
<b>Bodies</b>	Staying away from someone who is working on ICs	Touching others who are working on ICs
<b>Bags</b>	Using static-shielding bags	Bags that are not static-shield protected
<b>Leads</b>	Picking up ICs by the body	Picking up ICs by the pins
<b>Synthetics</b>	Non Synthetic materials: wood, glass, cotton	Styrofoam, polyester, vinyl, plastic
<b>Metals</b>	Use antistatic mats or foam	Placing ICs on metal
<b>Atmosphere</b>	Humidity between 70% and 90%	Humidity below 70%

**TABLE 1**

### Spreading the Word about ESD

Let's say that you always follow the ESD prevention rules but, as shown in the videotape, visitors to your work area still pose considerable risk to your equipment. What can you do to keep other people from unknowingly becoming ESD hazards?

You need to educate them. As a technical expert at your site, you may be able to inform your fellow workers and customers tactfully about the dangers of ESD and its prevention.

### Videotape

Share the videotape *The Shocking Truth* with other people at your site. It is an easy and entertaining way to educate your fellow workers.

### Set an Example

Another way to encourage ESD-safe behavior in your workshop is to be certain that you set a good example by always following the ESD prevention rules. At times, you may find it appropriate to explain, for example, why you keep Styrofoam away from the work area.

Remember to follow the ESD prevention rules at all times. It's the only safe way.

**Continue with the next section, Exercise: Preventing ESD.**

---

## Exercise: Preventing ESD

### Part 1

Indicate whether the following items are correct or incorrect by checking TRUE or FALSE.

1. A static discharge as little as 30 volts can damage some circuit boards.

☒ TRUE    ☐ FALSE

2. You can feel a static discharge of 30 volts.

☐ TRUE    ☒ FALSE

3. A charged nonconductor (for example, a Styrofoam cup) can cause damage only if it touches the circuit board.

☐ TRUE    ☒ FALSE

4. Testing circuit boards is a sure way of determining whether or not they have been damaged by ESD.

☐ TRUE    ☒ FALSE

5. Usually you cannot see the damage caused by ESD.

☒ TRUE    ☐ FALSE

## EXERCISE: PREVENTING ESD

---

6. State two ways that you could "spread the word" about the risks of ESD and its prevention.

a. Show the video "The Shocking

Truth"

b. Be a good example.

Compare your answers to those on the next page.

---

## Exercise: Preventing ESD (Answers)

### Part 1

Compare your answers to the statements below.

1. TRUE. An ESD of as low as 30 volts can damage many modern-day circuit boards.
2. FALSE. If you can feel the voltage, it is probably as high as 3,000.
3. FALSE. The electrostatic field surrounding the nonconductor can discharge voltage to the conductor and thus damage it—without the two objects touching.
4. FALSE. ESD often degrades the circuits in a way that the system will continue to function and thus pass the diagnostic tests, but at a later time, the unit may start to malfunction.
5. TRUE
6. Here are some things you could do to educate others about ESD:
  - a. Show the videotape to them.
  - b. Set an example by adhering to all ESD prevention rules.

If you missed more than one of these items, view the videotape again.

Continue with the next part of this exercise.

## Exercise: Preventing ESD

### Part 2

Write the seven ESD Prevention Rules in your own words.

1. Ground Yourself.
2. Don't touch anybody working on ICs
3. Use Static Bags
4. Wear & use nonconductive materials
5. No metal surfaces
6. Handle IC's by body not pins.
7. Work in high humidity envs

## Exercise: Preventing ESD (Answers)

### Part 2

Compare your answers to the statements below.

1. Before working on any device containing a printed circuit, ground yourself and your equipment to an earth or building ground.
2. Do not touch anybody who is working on integrated circuits.
3. Use static-shielding bags for boards and chips during storage, transportation, and handling.
4. Handle all ICs by the body, not by the leads.
5. Do not wear polyester clothing or bring plastic, vinyl, or Styrofoam into the work environment.
6. Never place components on any metal surface.
7. If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.

If you missed one or more of the items of this exercise, review the section "ESD Prevention Rules."

Continue with the next section, Equipment for Preventing ESD.

---

# Equipment for Preventing ESD

## ESD Protective Equipment

The first step in creating an ESD-safe workstation is to acquire the materials and tools that can help you prevent ESD damage.

This section describes these basic materials and provides tips regarding their use. In the next section, you will learn how to set up these materials at your workstation.

## Conductive Floor Mat

Using a conductive floor mat is one way to ground yourself. As soon as you step on the mat, you become grounded, and your body will not hold a static charge. If you use a floor mat, be sure that you step on the floor mat before reaching for your wrist strap or turning on an ion generator.

All visitors without wrist straps must also contact the floor mat before approaching the workstation.

## Wrist Strap

Using a properly grounded wrist strap is another way to ground yourself. As long as you are wearing a grounded wrist strap your body cannot hold a static charge.

Always put your wrist strap on before beginning work. Every time you put it on, inspect it to be sure it is connected properly. Be sure that it touches skin and fits snugly. Taking your wrist strap off should be the last thing you do before leaving the work area.

A common myth is that you do not need wrist straps unless you work on carpeted floors. That is not true; there is considerable ESD risk on all types of floors. Unless you are grounded, you can't be sure that you are ESD-safe.

Do not wear a wrist strap when working with cathode ray tubes (CRTs). CRTs carry high voltage that can be transferred to you through the wrist strap.

## Conductive Workbench Mat

A conductive workbench mat provides a work surface that is static-safe and will not hold a static charge. When you place conductive items like PCBs on the conductive mat, their static charge is drained to ground. Static shielding bags, conductive tote boxes, conductive foams, and conductive shipping tubes all lose their charge when placed on the mat.

Always lay conductive containers on the mat and attach your wrist strap before removing the components from the containers.

**Ground Cords**

Use a ground cord to ground your workbench mat. Know where the ground cords are located. Visually inspect them each day to be sure they have not been accidentally disconnected.

**Static-Shielding Bags**

A particularly hazardous time for static-sensitive components is during handling and shipping. Static charge on objects and people, even static buildup resulting from the movement of the parts themselves, can destroy or degrade parts. Whenever you transport or store boards and chips, use static-shielding bags for protection against static discharge and external static fields.

Some bags are just antistatic, which means they do not create static electricity, but neither do they shield their contents from external static fields. Be sure to use bags that are antistatic and static-shielding.

Be sure that the bags you use are new. Throw out bags that appear worn because they will not provide adequate protection.

**Ion Generator**

You cannot ground nonconductive materials, such as plastic and synthetic fabrics. An ion generator can help to neutralize their static charge.

If you use an ion generator, turn it on immediately after attaching your wrist strap.

**What Equipment Is Required**

You may not be able to acquire all the materials described above, but setting up an ESD-safe workstation requires at least the following:

- Conductive workbench mat with ground cord
- Wrist strap with 1 megohm resistor and ground cord
- Equipment ground cord with alligator clips
- Ground/polarity tester (to test grounding of power outlet)
- Static-shielding bags

You should be able to buy all of this equipment at a local electronics shop. If it is not available locally, here are two sources:

Apple Service,  
Part # 073-0251 ESD Prevention Kit

3 M Corporation,  
Electrical Specialties Static Control Division, at 800-328-1368

**Continue with the next section, Setting Up an ESD-Safe Workstation.**

---

# Setting Up an ESD-Safe Workstation

## Introduction

Before you start to work on any task involving circuit boards, you need to verify that your workstation is ESD safe. An ESD-safe workstation is one that has equipment and materials designed to prevent ESD damage.

This section will guide you through the steps to set up an ESD-free workstation. If you do not already have an ESD-safe workstation set up, perform these steps now. If you already have an ESD-safe workstation set up, just read these steps.

## Equipment You Need for this Exercise

To complete this exercise, you need the following:

- Conductive workbench mat with ground cord
- Wrist strap with 1-megohm resistor and ground cord
- Equipment ground cord with alligator clips
- Ground/polarity tester

If you do not have all the equipment required to set up an ESD-safe workstation, obtain it as soon as possible and then complete this exercise.

***Note:** The following steps may vary, depending on the ESD mat and equipment you use. Consult the instructions that come with the ESD equipment for further details.*

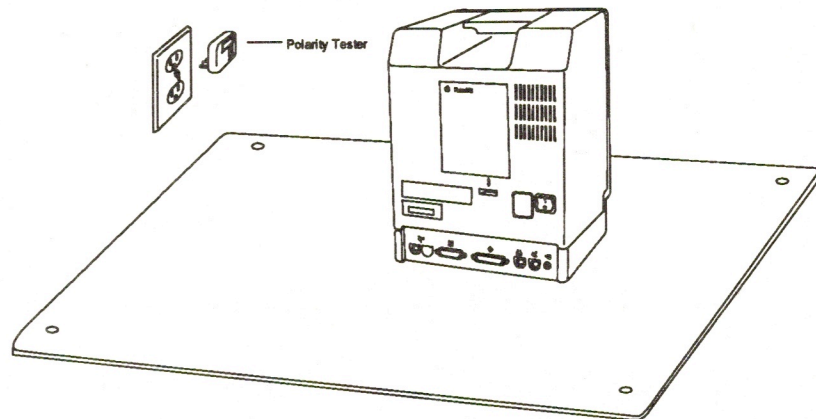
## Steps for Setting Up an ESD-Safe Station

To set up an ESD-safe workstation, follow these steps:

1. Remove all ESD hazards from your work area. That includes:
  - Anything made of Styrofoam, for example, Styrofoam coffee cups
  - Common plastics
  - Synthetic clothing
  - Vinyl

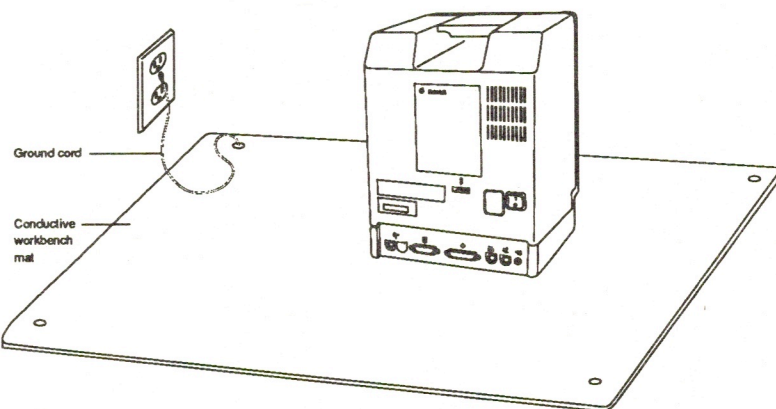
2. Use the ground/polarity tester to verify proper grounding of the power outlet.

Ground/polarity testers vary slightly in design, but all are very simple to use. Insert the three prongs of the tester into the three-prong outlet, as shown in Figure 1. Most testers display a discrete light pattern for each possible wiring configuration. You interpret the light display by referring to the code given on the tester.



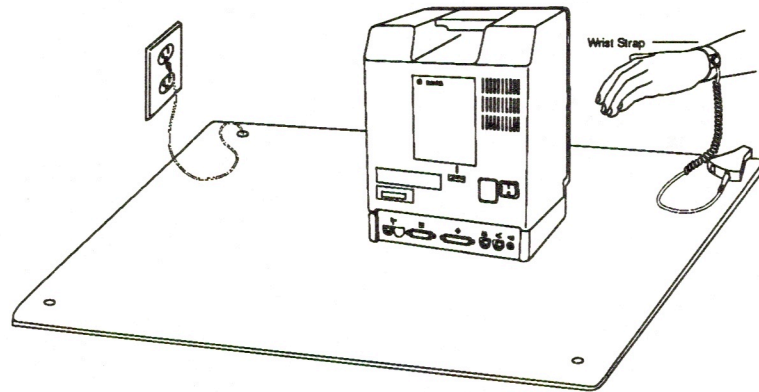
**Figure 1. Using a ground/polarity tester**

3. Lay out the conductive workbench mat. Use the ground cord to connect the mat to earth ground or to a building ground. Connecting the ground cord to the wall outlet box, as shown in Figure 2, is usually adequate, but to be certain about how to ground the mat, check with an electrician.



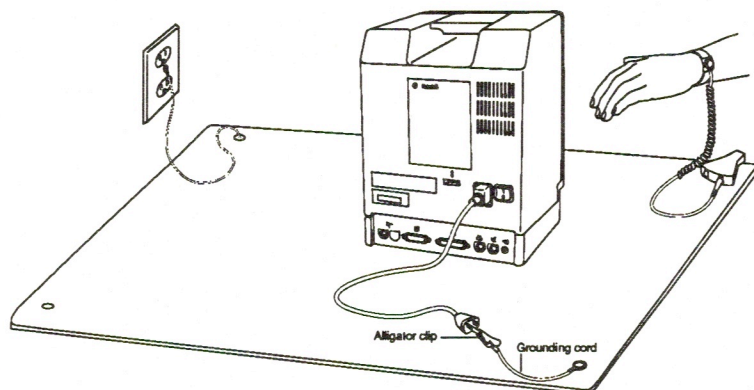
**Figure 2. Grounding the workbench mat.**

4. Fasten the wrist strap ground cord to the workbench mat and connect the wrist strap, as shown in Figure 3. Put the wrist strap around your wrist so that the strap touches your skin.



**Figure 3. Grounding the wrist strap**

5. Insert the power cord of the computer into the computer power socket. Do not plug the other end of the power cord into the wall outlet. Instead, use the ground cord with alligator clips to connect the ground pin (the long pin, sometimes called the "third wire") of the computer power cord to the workbench mat, as shown in Figure 4.



**Figure 4. Grounding the Computer**

### In the Field

When you work at a customer site, you need to take the same precautions to avoid ESD damage. Take time to make the work area ESD safe. Use a workbench mat and wrist strap. (For travel convenience, you may want to use mats that fold up.) Be sure everything is properly grounded, and never set parts on the floor.

**Continue with the Module Summary and Module Test.**

SUMMARY CHART	
<b>ESD RISKS</b>	Voltages as low as 30 volts can destroy a circuit board.
	Nonconductors can damage an IC or circuit board without touching it.
	You can't see ESD damage.
	ESD can degrade ICs causing long-term damage.
<b>PREVENTION RULES</b>	Ground yourself before working on equipment.
	Don't touch anyone working on equipment.
	Use static-shield bags to store and transport ICs.
	Handle ICs by the body, not by the pins.
	Avoid using polyester, Styrofoam, vinyl, or plastics when working on equipment.
	Do not place components on metal surfaces. Use a nonconductive surface, such as a foam mat.
	Keep the humidity between 70% and 90% in the service area.
<b>ESD PREVENTION EQUIPMENT</b>	Conductive workbench mat Conductive floor mat
	Wrist strap with 1 megohm resistor and cord, equipment ground cord with alligator clip
	Ground/polarity tester
	Static-shielding bags
	Ion generator

You have completed this module.

Check your skills and knowledge against the Skills Checklist.

---

# Module Test

For items 1 through 12, indicate whether the statements are correct or incorrect by checking TRUE or FALSE.

1. Static discharge must be at least 1000 volts before it can damage a circuit board.

\_\_\_ TRUE    ☒ FALSE

2. If you do not feel the static discharge when you pick up a circuit board, you can be certain that you have not caused any ESD damage.

\_\_\_ TRUE    ☒ FALSE

3. A charged nonconductor can damage a circuit board without actually touching it.

☒ TRUE    \_\_\_ FALSE

4. You should always test units after working on them because the tests will reveal any damage caused by ESD.

\_\_\_ TRUE    ☒ FALSE

5. You can reduce the risk of ESD damage by grounding the nonconductors in your work area.

\_\_\_ TRUE    ☒ FALSE

6. To be effective, a wrist strap must touch your skin.

☒ TRUE    \_\_\_ FALSE

7. You need to wear a wrist strap only if the floor in your work area is carpeted.

\_\_\_ TRUE    ☒ FALSE

8. You should not wear a wrist strap when you are working on live equipment.

☒ TRUE ☐ FALSE

9. An ion generator helps to neutralize the static charge of nonconductors.

☒ TRUE ☐ FALSE

10. You should frequently check ground cords to make sure they are connected.

☒ TRUE ☐ FALSE

11. When conductive materials are placed on a conductive workbench mat, the mat drains the static charge from the conductive materials.

☒ TRUE ☐ FALSE

12. You should use either antistatic bags or static-shielding bags to protect circuit boards from ESD damage.

☐ TRUE ☒ FALSE

Complete the remaining items by writing your answers.

13. Describe two ways that you can inform your fellow workers about the risks of ESD.

a. Show video

b. Set example

14. What are the seven ESD prevention rules?

a. Ground Yourself

b. Don't Touch others with I/O's.

c. Use Static Bags.

d. Wear non conductive clothing  
& use " " material

e. Don't touch pins

f. Work in high humidity

g. No metal Surface

15. List the five pieces of equipment or materials that you must have to help you prevent ESD.

- a. mat
- b. wrist strap
- c. Ground plug
- d. Twister
- e. Equip ground plug

Compare your answers to those on the following pages.

---

## Module Test (Answers)

Compare your answers to the following:

1. FALSE. A charge as low as 30 volts can damage some circuit boards.
2. FALSE. If you feel static discharge, the voltage is probably as high as 3,000 volts.
3. TRUE. The voltage from the electrostatic field surrounding a nonconductor can discharge to a circuit board without actual contact.
4. FALSE. The first part of this statement is true—you should test units after servicing them. The second part of the statement is false—tests do not always reveal ESD damage. ESD often degrades the circuits in a way that the system will continue to work until a later time, when the unit will start malfunctioning.
5. FALSE. You cannot ground nonconductors. You can try to neutralize the charge surrounding nonconductors by using an ion generator.
6. TRUE
7. FALSE. Walking on any type of floor can build up a considerable electrical charge.
8. TRUE. You must not wear a wrist strap when working on live equipment because the wrist strap will conduct the voltage from the live unit through your body. Wear the wrist strap only when working with equipment that is not plugged in.
9. TRUE
10. TRUE
11. TRUE
12. FALSE. You should use bags that are both antistatic and shielding. Some bags are just antistatic, which means they do not create static electricity, but they do not shield their contents from external static.

13. Two ways that you can inform your fellow workers about the risks of ESD:
  - a. Show them the videotape *The Shocking Truth*.
  - b. Set the example by following all ESD rules
14. These are the seven ESD prevention rules:
  - a. Before working on any device containing a printed circuit, ground yourself and your equipment to an earth or building ground.
  - b. Don't touch anybody who is working on integrated circuits.
  - c. Use static-shielding bags for boards and chips during storage, transportation, and handling.
  - d. Handle all ICs by the body, not by the leads.
  - e. Do not wear polyester clothing or bring plastic, vinyl, or Styrofoam into the work environment.
  - f. Never place components on any metal surface.
  - g. If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.
15. These are the five pieces of equipment and materials that you must have to help you prevent ESD.
  - a. Conductive workbench mat
  - b. Wrist strap, with 1 megohm resistor and ground cord
  - c. Equipment ground cord, with alligator clips
  - d. Ground/polarity tester
  - e. Static-shielding bags

**Reminder:** *Completing this written test does not verify that you can perform the hands-on tasks covered in this module. Be sure you can perform all of the tasks on the Skills Checklist.*

**Before continuing with the next module, refer to the evaluation booklet and complete the evaluation for this module.**



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# Macintosh Basic Features

## Table of Contents

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# Module Introduction

## Overview

As you learned in the Welcome to Apple Service module, Apple offers three types of Macintosh computers: compact, modular, and portable. This module describes the basic features and configurations of the compact and modular Macintosh computers. In later modules, you will learn how to set up and use these Macintosh computers. The portable computer is covered in another course.

## What You Will Learn

By the end of this module, you should be able to identify the basic features and configurations of these compact Macintosh computers:

- Macintosh Plus
- Macintosh SE
- Macintosh SE/30
- Macintosh Classic

and these modular Macintosh computers:

- Macintosh II
- Macintosh IIfx
- Macintosh IIfx
- Macintosh IIfx
- Macintosh IIfx
- Macintosh IIfx
- Macintosh IIfx
- Macintosh LC

## How You Will Be Tested

The Skills Checklist following this Module Introduction lists, in detail, the tasks you should be able to perform upon completion of this module.

## The Module Test

This written test will help you verify that you can perform the tasks outlined in the Skills Checklist. It will also prepare you for the prerequisite exam, which must be passed before you proceed to the lab portion of this course.

### **The Prerequisite Exam**

Consisting of hands-on and written items, this test will verify that you have mastered the module skills listed and are ready for the lab part of this course.

Throughout all of the tests and activities, you will be able to refer to these instructional materials and to other Apple reference materials.

### **Prerequisites to the Module**

Before beginning this module, you must have satisfactorily completed the module, Welcome to Apple Service.

### **Materials Needed for this Module**

The Prerequisite provides the following items for this module:

- This Module Workbook
- Module Test

### **How the Module Is Organized**

This module is presented in two parts.

#### **Part 1: Compact Macintosh Computers**

This part describes the basic features and configurations of compact Macintosh computers, including the Macintosh Plus, Macintosh SE, Macintosh SE/30, and Macintosh Classic.

#### **Part 2: Modular Macintosh Computers**

This part describes the basic features and configurations of modular Macintosh computers, including the Macintosh II, Macintosh IIfx, Macintosh IIfx, Macintosh IICx, Macintosh IICi, Macintosh IISI, and the Macintosh LC.

Following these parts is a Module Summary.

**Continue with the Skills Checklist on the following pages.**

---

# Skills Checklist

## **What Is the Skills Checklist?**

This is a list of tasks that you should be able to perform at the conclusion of this module. The Prerequisite Exam (written and hands-on) will cover these items. During the lab part of this course, you will be expected to perform all of these tasks.

## **How to Use the Checklist**

Before starting the module, you should check the items on this list. If you are confident that you can already perform certain tasks, you may decide to skip those parts of the module. Or you may decide to try the Module Test without going through the module.

After completing the module, you should check this list to make certain that you have mastered all of the skills before you attend the Prerequisite Exam and the Lab part of this course. If you feel uncertain about any of these tasks, return to the section indicated, review the information, and repeat the hands-on activities.

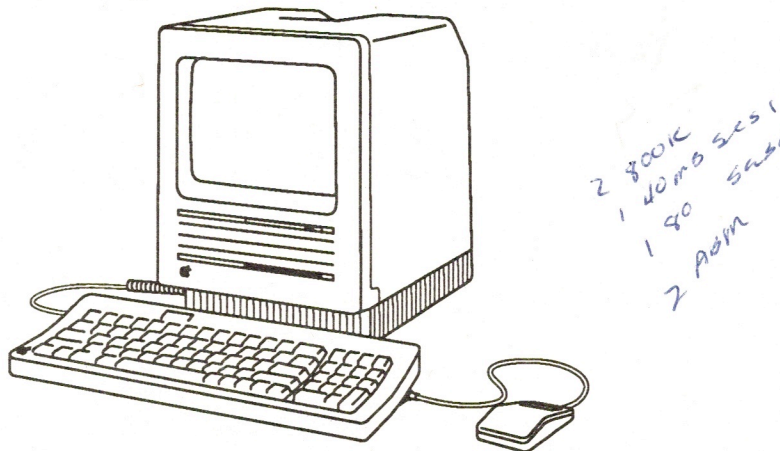
Task	Where the Task is Covered
___ 1. Identify the drive configurations available for the compact Macintosh computers.	Compact Macintosh Features and Configurations
___ 2. State the RAM capabilities for the compact Macintosh computers.	Compact Macintosh Features and Configurations
___ 3. State the amount of ROM available in the compact Macintosh computers.	Compact Macintosh Features and Configurations
___ 4. Explain what the Apple DeskTop Bus supports.	Compact Macintosh Features and Configurations
___ 5. Identify the type of microprocessor used by each compact Macintosh computer.	Compact Macintosh Features and Configurations
___ 6. Identify the drive configurations available for the modular Macintosh computers.	Modular Macintosh Features and Configurations
___ 7. State the RAM capabilities for the modular Macintosh computers.	Modular Macintosh Features and Configurations
___ 8. State the amount of ROM available in the modular Macintosh computers.	Modular Macintosh Features and Configurations
___ 9. Identify the type of microprocessor used by each modular Macintosh computer.	Modular Macintosh Features and Configurations
___ 10. Identify the number and type of expansion slots provided in each of the modular Macintosh computers.	Modular Macintosh Features and Configurations
___ 11. Identify the Apple monitors that can be used by each modular Macintosh computer.	Modular Macintosh Features and Configurations
___ 12. Identify the modular Macintosh computers that have on-board video.	Modular Macintosh Features and Configurations

Continue with the next section, **Compact Macintosh Features and Configurations.**

# Compact Macintosh Features and Configurations

## The Compact Macintosh Systems

The Macintosh Plus, the Macintosh SE, the Macintosh SE/30, and the Macintosh Classic are compact computers with built-in disk drive(s), video, and sound. The keyboard and mouse are detached. Figure 1 shows the Macintosh SE.



**Figure 1. The Macintosh SE with keyboard and mouse**

Externally, the Macintosh Plus, SE, SE/30, and the Classic are similar in appearance, but the four models have different features and configurations.

This section will describe the similarities and differences among these computer models by describing their drive configurations, microprocessors, memory capacity, ports, and connectors.

### The Macintosh Plus

*Note: The Macintosh Plus is no longer in production.*

#### Drive Configuration

The Macintosh Plus, shown in Figure 2, has one 800K 3.5-inch internal disk drive ("floppy drive"). The 800K disk drive reads and writes data on both sides of a 3.5-inch floppy diskette. (As compared with the 400K disk drive, used with earlier Macintosh computers, which reads and writes data on only one side of a 3.5-inch diskette.)

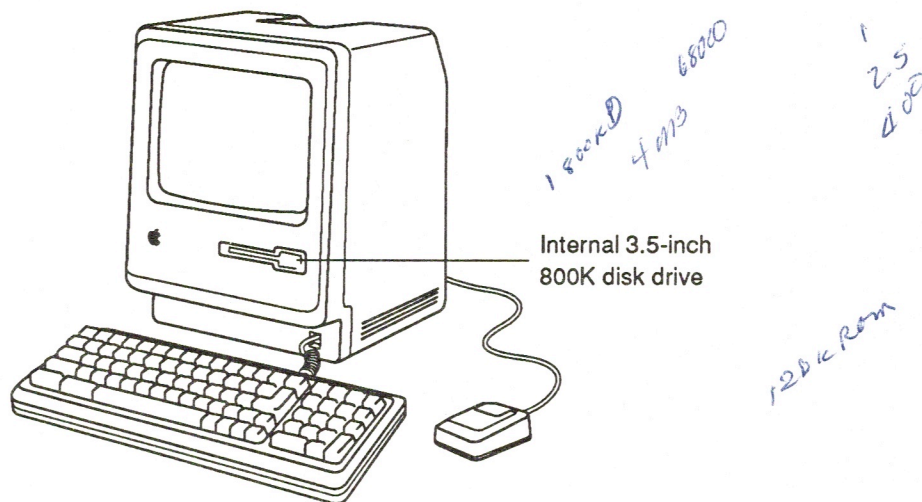


Figure 2. The Macintosh Plus

#### Microprocessor

The Macintosh Plus uses a Motorola MC68000 microprocessor operating at 8 MHz.

#### Memory

The standard Macintosh Plus comes with 1 megabyte (MB) of random-access memory (RAM), and can be upgraded to 2.5 MB, or 4 MB. RAM memory ICs are mounted on circuit boards called single in-line memory modules (SIMMs), which are installed in SIMM sockets on the main logic board.

The Macintosh Plus has 128K of read-only memory (ROM).

### Ports and Connectors

The Macintosh plus has the following ports and connectors:

- One SCSI connector
- Two serial ports
- One external floppy disk connector
- One mono audio jack
- One mouse port

The Small Computer System Interface (SCSI) port is for high-speed parallel communications with peripheral devices such as hard disks, tape drives, scanners, and CD ROM drives. This was the first Macintosh to have a SCSI port. (You will learn more about SCSI later in this course.)

The two all-purpose serial ports (RS422/RS232 connectors) are used for printers and modems. The external floppy disk port is used to connect an optional 3.5-inch 800K disk drive. The Macintosh Plus also has a mono audio jack and a mouse port.

You will learn the locations and uses of the ports and connectors later in this course.

### Keyboard

The Macintosh Plus uses the keyboard shown in Figure 3.

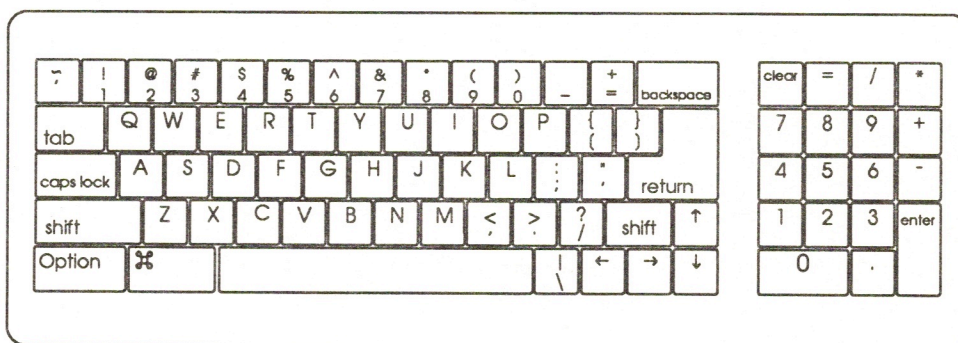


Figure 3. Macintosh Plus keyboard

## The Macintosh SE

### *Drive Configurations*

The standard Macintosh SE comes with the Apple FDHD/SuperDrive (Floppy Drive High Density). The FDHD/SuperDrive is a 1.44 MB 3.5-inch disk drive that can read and write data on single-sided, double-sided, and high-density 3.5-inch disks. With additional software, the FDHD/SuperDrive can also exchange data files with MS-DOS, OS/2, and ProDOS systems. With 1.44 MB, the FDHD/SuperDrive provides nearly twice the storage space as the 800K 3.5-inch disk drive in the Macintosh Plus.

Besides the standard configuration, there are two other configurations for the Macintosh SE. The following show the possible configurations:

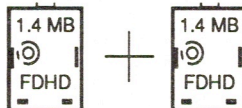
#### Standard

- One FDHD/SuperDrive



#### Optional

- Two internal FDHD/SuperDrive



- One internal FDHD/SuperDrive and one internal 20 or 40 MB SCSI hard disk



Figures 4 and 5 on the next page show where the drives are placed for the two options.

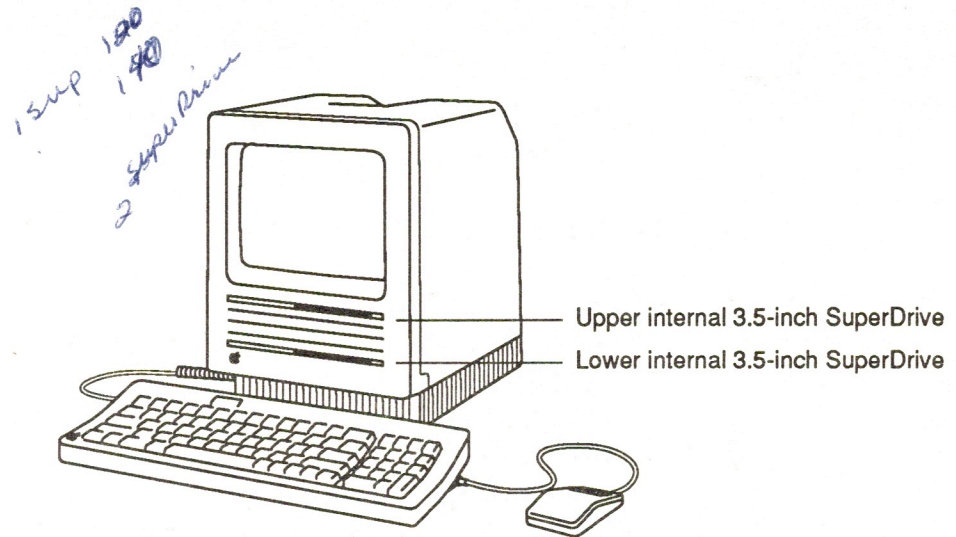


Figure 4. The Macintosh SE with two internal FDHD/SuperDrive

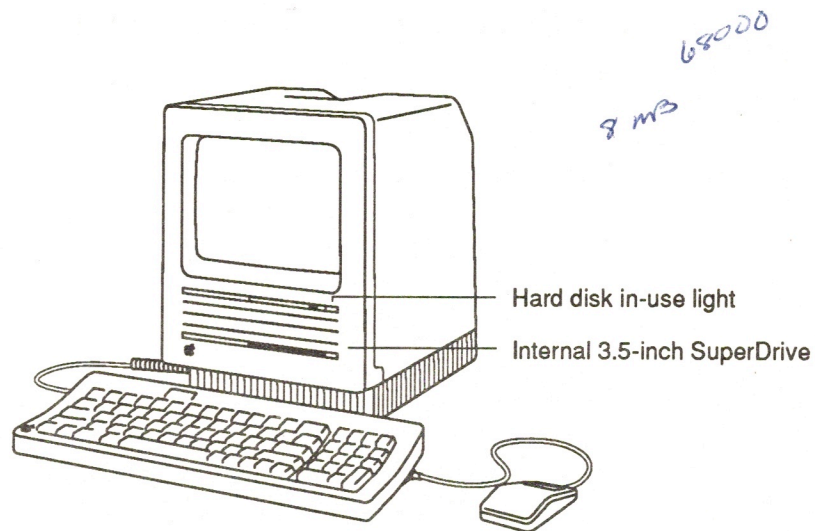


Figure 5. The Macintosh SE with an internal hard disk

#### *Configuration Upgrades*

Users who have older Macintosh SE configurations, which included the 800K 3.5-inch disk drive instead of the FDHD/SuperDrive, may upgrade their systems to a FDHD/SuperDrive configuration.

#### *Microprocessor*

Like earlier versions of the Macintosh, the Macintosh SE uses a Motorola MC68000 microprocessor operating at 8 MHz.

## Memory

Either 1 or 2 MB of RAM, provided on SIMMs, is standard for the Macintosh SE. It can be upgraded to 2, 2.5, or 4 MB of RAM.

The Macintosh SE has 256K of ROM.

## Ports and Connectors

The Macintosh SE has the following ports and connectors:

- One SCSI port
- Two serial ports
- One stereo audio jack
- Two ADB (Apple Desktop Bus) ports

The Macintosh SE receives user input through the Apple Desktop Bus (ADB). The ADB allows you to connect more than one input device—such as a mouse, keyboard, graphics tablet, numeric keypad—without modifying the basic system hardware. This input system is called a bus because several devices can send information along one “bus line” to the computer. The Macintosh SE was the first Macintosh to use the ADB.

## Expansion Slot

The Macintosh SE has one expansion connector (slot) that allows you to connect an optional circuit board to support specialized functions not otherwise supported by the computer, for example, large-screen monitors. The Macintosh SE was the first Macintosh to provide for such expansion.

## Keyboard

The introduction of the Apple Desktop Bus (ADB) on the Macintosh SE resulted in different keyboard requirements for the various compact Macintosh computers. Whereas the Macintosh Plus uses the original Macintosh keyboard, the Macintosh SE requires an ADB keyboard. Apple offers two ADB keyboard options—the Apple Keyboard and the Apple Extended Keyboard, as shown in Figures 6 and 7.

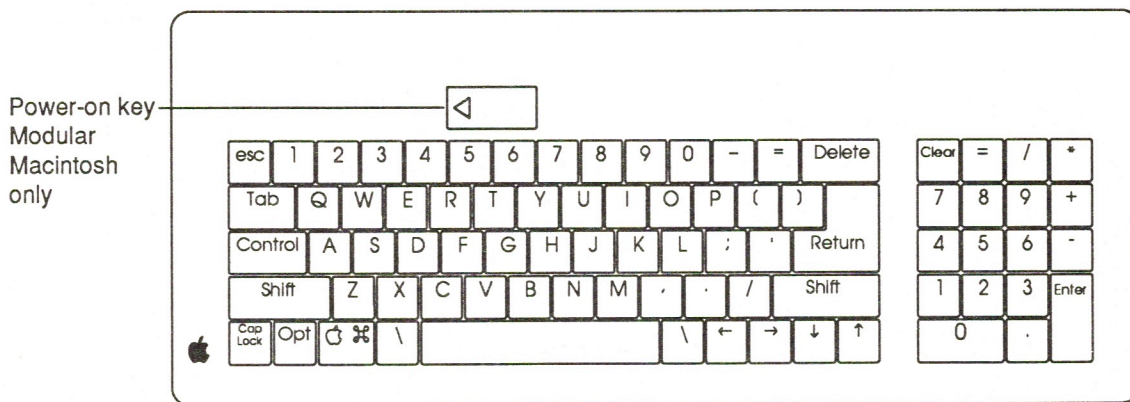
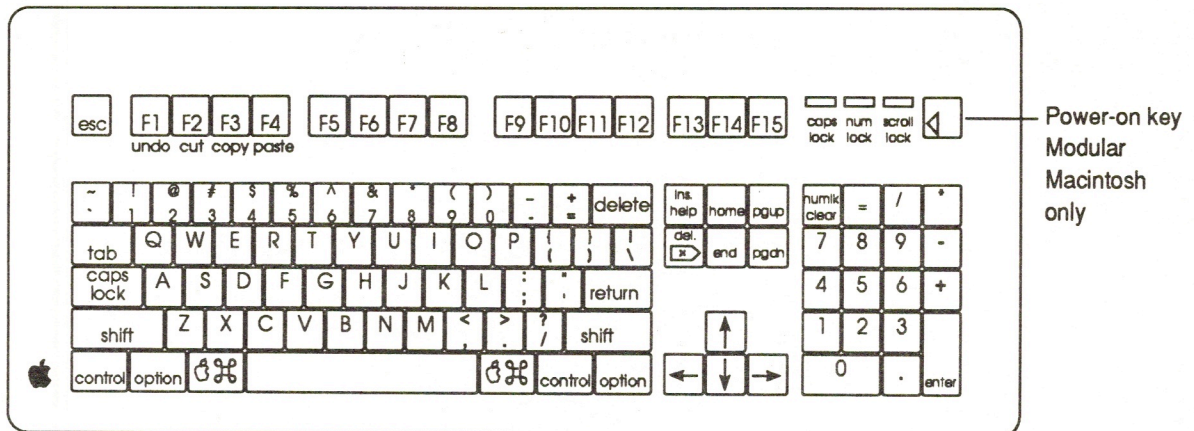


Figure 6. The Apple Keyboard

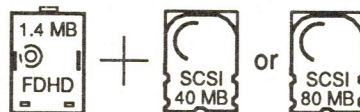


**Figure 7. The Apple Extended Keyboard**

## The Macintosh SE/30

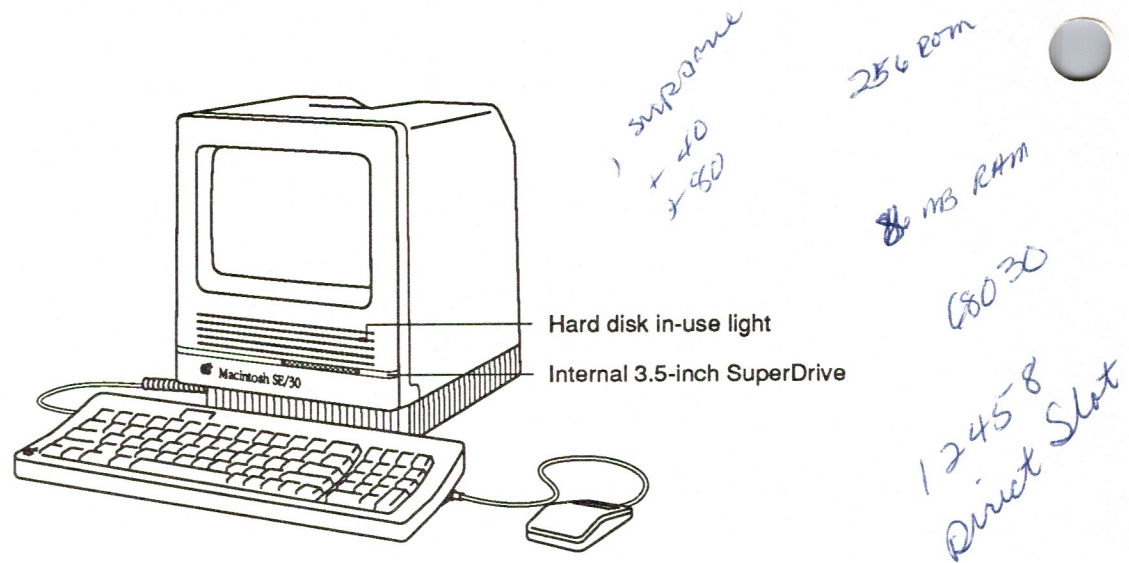
### Drive Configuration

The standard SE/30 comes with the FDHD/SuperDrive and a 40 MB or 80 MB internal SCSI hard disk.



Note that the only configuration choice for the SE/30 is between the 40 or 80 MB hard disk. The SE/30 is not available with two internal floppy disk drives. (As compared to the Macintosh SE which can support two internal floppy drives.)

The external appearance of the SE/30, as shown in Figure 8 on the next page, is similar to that of the Macintosh SE with the internal hard disk.



**Figure 8. The Macintosh SE/30**

## Microprocessor

The Macintosh SE/30 uses a Motorola MC68030 microprocessor, which operates at 16 MHz, twice the clock speed of the 68000 microprocessor in the Macintosh Plus and SE. The SE/30 can perform most tasks much faster than the SE.

The MC68030 microprocessor supports "paged memory management," required for multitasking operating systems such as UNIX. Paged memory management is a technique that allows the microprocessor to access much more data than can fit in RAM at one time. A "page" is a fixed-size chunk of memory that is swapped in and out of the disk. Many microprocessors require a dedicated paged memory management coprocessor, often called a paged memory management unit (PMMU). The microprocessor on the SE/30 (MC68030) has build-in paged memory management.

The capabilities of the MC68030 are extended by a Motorola 68882 floating-point coprocessor. The term *floating-point* refers to the method of performing calculations on large numbers. The 68882 coprocessor handles these large-number computations, leaving the MC68030 free to perform other tasks, resulting in increased performance.

## Memory

The standard Macintosh SE/30 comes with either 1 or 4 MB of RAM provided on SIMMs, and can be upgraded to 2, 4, 5, or 8 MB of RAM.

The SE/30 has 256K of ROM. The Macintosh SE/30 ROM chips are contained on a SIMM that is installed in its own ROM SIMM socket. (Compare this to the Macintosh SE on which the ROM chips are socketed on the main logic board.)

### **Ports and Connectors**

The Macintosh SE/30 has the same external connectors as the Macintosh SE:

- Two ADB connectors
- One SCSI port
- One floppy disk drive port
- Two serial ports
- One stereo audio output jack

### **Expansion Slot**

Like the Macintosh SE, the Macintosh SE/30 has one expansion slot, but the SE/30 expansion card communicates directly to the 68030 microprocessor. Communication with this SE/30 "direct slot" expansion card is twice as fast as communication with an SE expansion card.

The expansion slots on the SE and the SE/30 are not compatible, which means that these two products cannot use the same expansion cards.

### **Keyboard**

Like the Macintosh SE, the Macintosh SE/30 requires either of the two Apple ADB keyboards:

- Apple Keyboard
- Apple Extended Keyboard

## **Macintosh Classic**

### **Drive Configuration**

The configurations for the Macintosh Classic (Figure 9, next page) are as follows:

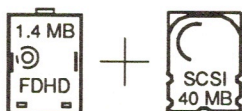
#### Standard

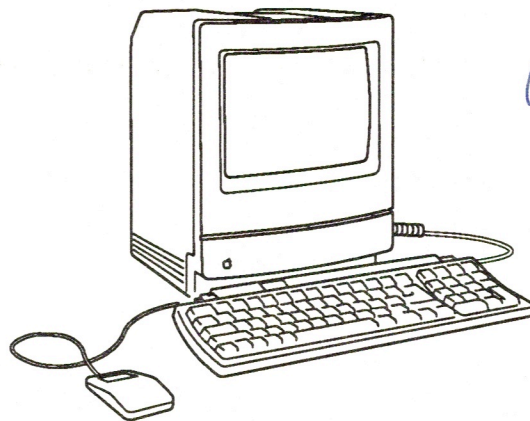
One internal 1.4 MB Apple FDHD/SuperDrive



#### Optional

One internal Apple FDHD/SuperDrive and 40 MB SCSI hard disk





**Figure 9. The Macintosh Classic**

### ***Microprocessor***

The Macintosh Classic uses a Motorola 68000 microprocessor operating at 8 MHz. Even though the Classic is running at the same clock speed as the Macintosh Plus, it is 25% faster than the Macintosh Plus. This gain in speed occurs through the use of a new circuit on the logic board that reads two video bytes at a time instead of only one. This action reduces the number of RAM accesses by the CPU.

The Classic does not have a coprocessor.

### ***Memory***

#### ROM

Unlike the other compact models, the Classic comes with 512K of ROM.

#### RAM

The standard Macintosh Classic comes with one megabyte of RAM that is soldered on the main logic board. The memory on the Classic is expanded differently than on the other compact models. The second megabyte of memory is added by installing an optional memory expansion board that is unique to the Macintosh Classic. The 44-pin expansion board contains one megabyte of soldered-in RAM and two SIMM sockets in which 256K or 1 MB SIMMs can be installed. Installing just the expansion board increases the memory to two megabytes. Installing 256K SIMMs on the board increases the total memory to two and a half megabytes, and installing 1 MB SIMMs on the board increases the total memory to four megabytes.

### ***Keyboards***

The Macintosh Classic can use any of the ADB Apple keyboards, which include:

- Apple Keyboard
- Apple Keyboard II
- Apple Extended Keyboard
- Apple Extended Keyboard II

The Apple Keyboard II and Apple Extended Keyboard II are new ergonomically designed keyboards that replace the Apple Keyboard and Apple Extended Keyboard. The new keyboards have all the features of the older keyboards, plus the following design features: Quite touch membrane keyboard, non-replaceable key switches and key caps, and an adjustable lever in the rear of the keyboard that allows the user to tilt the keyboard. It can be adjusted from six to fourteen degrees from horizontal, depending on the needs of the user.

### ***Ports and Connectors***

Ports and connectors on the Macintosh Classic are similar to those on the other compact Macintosh computers except the Classic has only one ADB port, the rest are as follows:

- One SCSI port
- Two serial ports
- One monaural sound output port
- One external floppy drive port (supports a FDHD/SuperDrive or a 800K drive)

### ***Expansion Ports***

The Macintosh Classic contains only the one expansion port for use with the memory expansion card.

---

## Exercise: Compact Macintosh Computers

Answer the following questions by circling the letter before each correct answer.

1. Which of the following configurations does Apple currently offer for the Macintosh Plus?
  - A. One internal 400K 3.5-inch disk drive
  - ☒ B. One internal 800K 3.5-inch disk drive
  - C. One internal 400K 3.5-inch disk drive and one internal 800K 3.5-inch disk drive
  - D. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk drive
  - E. One internal 800K 3.5-inch disk drive and one Apple SuperDrive
  
2. Which of the following configurations does Apple currently offer for the Macintosh SE? Identify all correct answers.
  - ☒ A. Two internal 800K 3.5-inch disk drives
  - ☒ B. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk drive
  - ☒ C. One Apple SuperDrive
  - ☒ D. Two Apple SuperDrives
  - ☒ E. One Apple SuperDrive and one internal 40 MB SCSI hard disk drive
  
3. Which of the following configurations does Apple currently offer for the Macintosh SE/30?
  - A. Two internal 800K 3.5-inch disk drives
  - B. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk drive
  - ☒ C. Two Apple SuperDrives
  - ☒ D. One Apple SuperDrive and one internal 40 MB SCSI hard disk drive
  - E. One internal 40 MB SCSI hard disk and one internal 80 MB SCSI hard disk

4. Which of the following configurations does Apple currently offer for the Classic?

- ✓ A. One internal FDHD/SuperDrive
- B. Two internal FDHD/SuperDrive
- ✓ C. One internal FDHD/SuperDrive and one internal 40 MB SCSI hard disk
- D. One internal FDHD/SuperDrive and one internal 80 MB SCSI hard disk
- E. Two internal FDHD/SuperDrive and one internal 40 MB SCIS hard disk

5. What is the maximum amount of RAM that you can install in each of the following?

- A. Macintosh Plus 4 MB
- B. Macintosh SE 4 MB
- C. Macintosh SE/30 8 MB
- D. Macintosh Classic 1 MB

6. How much ROM does each of the following computers come with?

- A. Macintosh Plus 128 K
- B. Macintosh SE 256 K
- C. Macintosh SE/30 512 K
- D. Macintosh Classic 512 K

7. Which of the following devices does the ADB support? Circle the letters corresponding to all correct answers.

- A. Keyboard
- B. Hard disk
- C. Printer
- D. Mouse

## EXERCISE: COMPACT MACINTOSH COMPUTERS

8. Here is a list of features. Indicate which Macintosh has each feature by checking the appropriate.

	Macintosh Plus	Macintosh SE	Macintosh SE/30	Macintosh Classic
a. ADB	_____	_____✓	_____✓	_____✓
b. MC68000 microprocessor	_____✓	_____✓	_____	_____✓
c. MC68030 microprocessor	_____	_____	_____✓	_____
d. Paged Memory Management	_____	_____	_____✓	_____✓
e. 68882 coprocessor	_____	_____	_____✓	_____
f. Serial ports	_____✓	_____✓	_____✓	_____✓
g. Direct expansion slot	_____	_____✓	_____✓	_____
h. Expansion slot (not direct)	_____	_____✓	_____	_____✓
i. SCSI	_____✓	_____✓	_____✓	_____✓
j. ROM on a SIMM	_____	_____	_____✓	_____✓

Compare your answers to those provided on the following pages.

---

## Exercise: Compact Macintosh Computers (Answers)

Compare your answers to the ones below:

1. B
2. C, D, and E
3. D
4. A and C
5. Macintosh Plus, 4 MB  
Macintosh SE, 4 MB  
Macintosh SE/30, 8 MB  
Macintosh Classic, 4 MB
6. Macintosh Plus, 128K  
Macintosh SE, 256K  
Macintosh SE/30, 256K  
Macintosh Classic, 512K
7. A and D

## EXERCISE: COMPACT MACINTOSH COMPUTERS (ANSWERS)

---

8.		Macintosh Plus	Macintosh SE	Macintosh SE/30	Macintosh Classic
a.	ADB	—	<u>X</u>	<u>X</u>	<u>X</u>
b.	MC68000 microprocessor	<u>X</u>	<u>X</u>	—	<u>X</u>
c.	MC68030 microprocessor	—	—	<u>X</u>	—
d.	Paged memory management	—	—	<u>X</u>	—
e.	68882 coprocessor	—	—	<u>X</u>	—
f.	Serial ports	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
g.	Direct expansion slot	—	—	<u>X</u>	—
h.	Expansion slot (not direct)	—	<u>X</u>	—	<u>X</u>
i.	SCSI	<u>X</u>	<u>X</u>	<u>X</u>	<u>X</u>
j.	ROM on a SIMM	—	—	<u>X</u>	—

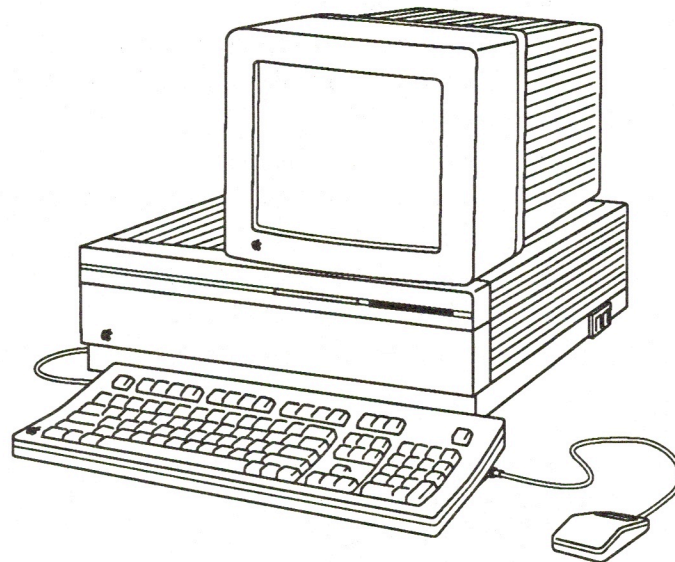
If you had difficulty with any of the items on this exercise, review Compact Macintosh Features and Configurations.

**Continue with the next section, Modular Macintosh Features and Configurations.**

# Modular Macintosh Features and Configurations

## The Modular Macintosh Systems

Currently there are seven modular Macintosh computers: the Macintosh II, Macintosh IIfx, Macintosh ILCx, Macintosh ILCi, Macintosh IIfx, Macintosh ILSi and the Macintosh LC. Each of these modular computer systems has a monitor, keyboard, and mouse that is separate from the computer. Figure 9 shows the Macintosh II as an example.



**Figure 9. A Macintosh II system**

Although they are similar in many ways, each modular computer has one or more unique features. To differentiate what features are similar and what are unique, this section first separates the units into groups with similar features, then presents each computer individually and lists its unique features.

The seven modular Macintosh units can be divide into three groups. The criteria used to separate these groups is the physical size of the unit and the expansion slot capabilities. The groups are:

- Macintosh II, Macintosh IIfx, and Macintosh IIfx — with six expansion slots (all NuBus)
- Macintosh ILCx and Macintosh ILCi — with three expansion slots (all NuBus)
- Macintosh ILSi and Macintosh LC — with one expansion slot (different type, explained later)

### Group One — Common Features

The first group, consisting of the Macintosh II, Macintosh IIfx, and Macintosh IIfx computers, all have the same size footprint and the following features in common:

#### *Monitors*

The monitor is not built into the modular Macintosh computers, so a variety of monitors can be used. All Macintosh monitors currently available from Apple are compatible with each of the computers in this first group. However, each of these computers needs a video card in one of the NuBus slots to support the listed monitors. The monitors are:

- Apple High-Resolution Monochrome
- Macintosh 12-inch Monochrome Display (replaces the High-Resolution Monochrome)
- AppleColor High-Resolution RGB
- Macintosh 12-inch RGB Display (replaces the AppleColor High-Resolution RGB)
- Apple Macintosh Portrait Display
- Apple Two-Page Monochrome

Also see the monitor chart in the Summary at the end of this module.

#### *Keyboards*

All of the computers in this first group can use any of the ADB Apple keyboards currently available, which include:

- Apple Keyboard
- Apple Keyboard II
- Apple Extended Keyboard
- Apple Extended Keyboard II

#### *Memory*

Each Macintosh in this group comes with the RAM memory in SIMMs. The Macintosh II and IIfx come with one or four megabytes of RAM, and the Macintosh IIfx comes with four megabytes. Each of the computers can be upgraded to two, five, or eight megabytes of RAM.

All have floating-point coprocessors.

#### *Ports and Connectors*

The three Macintosh units in this group have the same output ports and connectors, which are:

- Two serial ports
- One external SCSI connector
- One stereo audio jack
- Two ADB ports

**Expansion Slots**

Each computer has Six NuBus slots.

**Group Two, Common Features**

The Macintosh IICx and Macintosh IICI form the second group. The two units are exactly alike in appearance and size, which is a smaller footprint than the computers in the first group. These two units have the following features in common:

**Monitors**

Both units can support the full range of Apple monitors available, but in different ways. The Macintosh IICx needs a video card to support all the monitors listed below. The Macintosh IICI has a built-in video which supports all of the monitors except the Apple Two-Page Monochrome. When used with the IICI, the Apple Two-Page Monochrome requires a video card. The advantage of built-in video in the IICI is that none of the NuBus slots has to be used for a video card unless the user chooses this option. The monitors that can be used with these computers are:

- Apple High-Resolution Monochrome
- Macintosh 12-inch Monochrome Display (replaces the High-Resolution Monochrome)
- AppleColor High-Resolution RGB
- Macintosh 12-inch RGB Display (replaces the AppleColor High-Resolution RGB)
- Apple Macintosh Portrait Display
- Apple Two-Page Monochrome

Also see the monitor chart in the Summary at the end of this module.

**Keyboards**

Both these computers can be used with any of the ADB Apple Keyboards, which include:

- Apple Keyboard
- Apple Keyboard II
- Apple Extended Keyboard
- Apple Extended Keyboard II

**Memory**

Both computers come with either one or four megabytes of memory in two banks of SIMMs, and can be upgraded to two, five or eight megabytes of RAM.

See the individual descriptions for information on the ROM and microprocessor.

### ***Ports and Connectors***

The two computers have the outputs listed below, but the Macintosh IIfx also has a video output connector.

- Two serial ports
- One external SCSI connector
- One stereo audio jack
- Two ADB ports
- One floppy disk drive connector (for use with a 3.5-inch, 800K drive or an Apple FDHD/SuperDrive).
- One video output connector (Macintosh IIfx only)

### ***Expansion Slots***

One of the main differences between the computers in Group One and the Macintosh IIfx and Macintosh IIfx is that these two computers have only three NuBus expansion slots. As stated before, in the Macintosh IIfx, one of the slots must be used for a video card. The three slots in the IIfx, with built-in video, can be use for other NuBus expansion cards.

## **Group Three, Common Features**

The Macintosh IIfx and Macintosh LC make up the third group. While these two computers are not alike, they are different enough from the other modular Macintosh computers to be discussed in a separate group. Both computers are smaller in size than the other modular Macintosh units. Both have built-in video and both have only one expansion slot, although the slots are not the same. They will be discussed in their individual sections. The items these Macintosh computers have in common are:

### ***Monitors***

Primarily, the two newest monitors, the Macintosh 12-inch Monochrome Display and the Macintosh 12-inch RGB Display, were developed to accommodate these two computers. But most of the other Apple monitors will work for either computer. The exception to this is:

For the Macintosh IIfx

It needs a video card to work with the Apple Two-Page monitor.

For the Macintosh LC

It is not compatible with the Apple Portrait Display and the Apple Two-Page monitor.

See the monitor chart in the Summary of this section.

### ***Keyboards***

The newest keyboards, Apple Keyboard II and Apple Extended Keyboard II, were developed to accommodate both computers; however, any of the ADB Apple Keyboards can be used. These include:

- Apple Keyboard
- Apple Keyboard II
- Apple Extended Keyboard
- Apple Extended Keyboard II

### ***Memory***

See the individual section for information about the memory.

### ***Port and Connectors***

The following connectors are common to both computers:

- One SCSI port
- Two serial ports
- One video connector
- One ADB port
- One output sound port (Mono on the LC; Stereo on the IIsi)
- One input sound port

Each of these computers now has only one ADB port. Since the ADB bus is a serial port that can be daisy chained, one port is needed to accommodate the keyboard. Other ADB devices, such as the mouse, graphic pad, or other peripherals, can be connected through the keyboard ADB port.

The other new port is an input sound port that allows the user to import sound into the computer (with the proper software). Because of this new feature, a microphone is standard equipment with these computers.

### ***Expansion Slots***

Each of these computers has one expansion slot; however, it is not a NuBus slot. The slot in the Macintosh IIsi uses one of two types of adapter cards. The adapter card is used to position the expansion card inside the computer, and to provide additional processing capability by adding a floating-point coprocessor. One card is designed to accommodate a NuBus card; with this adapter, any of the NuBus expansions cards that meet Apple specifications (under 15 Watts) can be used with the Macintosh IIsi. The other adapter card is designed to accommodate a 030 Direct Slot card.

The slot in the Macintosh LC is a 96-pin 020 Direct Drive slot (4 Watt limit), which can be used with the appropriate card, such as an Apple II emulator card or an Ethernet card, both of which are available from Apple.

**This ends the Common Features part of this section. Continue with the individual descriptions, presented next.**

## The Macintosh II

*Note: The Macintosh II is no longer in production.*

### Drive Configuration

The Macintosh II, shown in Figure 10, came with these possible configurations:

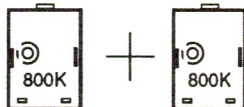
#### Standard

- One internal 800K 3.5-inch floppy disk drive



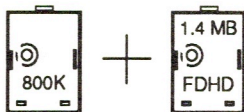
#### Optional

- Two internal 800K 3.5-inch floppy disk drives

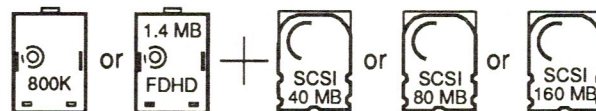


#### Upgrade (To upgrade with a FDHD/SuperDrive, a new ROM and IWM/SWIM chip is also needed.)

- An internal 800K 3.5-inch floppy disk drive and an optional FDHD/SuperDrive



- An internal 800K 3.5-inch floppy disk drive (FDHD/SuperDrive) and a 40, 80, or 160 MB internal SCSI hard disk



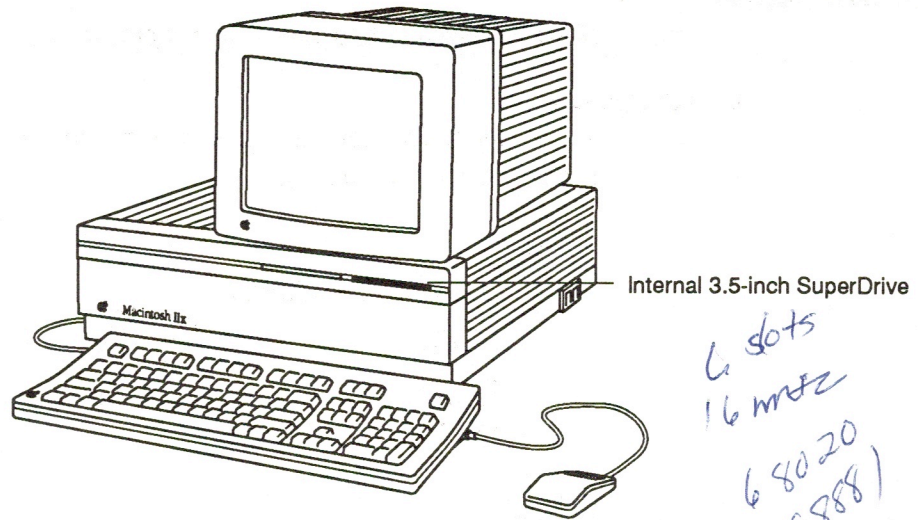


Figure 10. The Macintosh II

**Microprocessor**

The Macintosh II uses a Motorola MC68020 microprocessor running at 16 MHz. It also has a 68881 floating-point coprocessor for high-speed, precise numerics support. An optional paged memory management unit (PMMU), the Motorola MC68851, supports multitasking operating systems.

**Expansion Slots**

The Macintosh II has six NuBus slots.

## The Macintosh IIx

*Note: The Macintosh IIx is no longer in production.*

### Drive Configurations

The Macintosh IIx, shown in Figure 11, is the same size as the Macintosh II. The drive configurations are as follows:

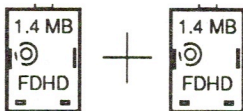
#### Standard

- One SuperDrive (FDHD)

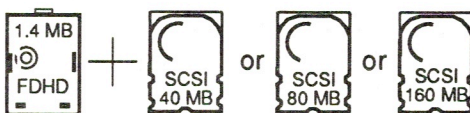


#### Optional

- Two internal FDHD/SuperDrive

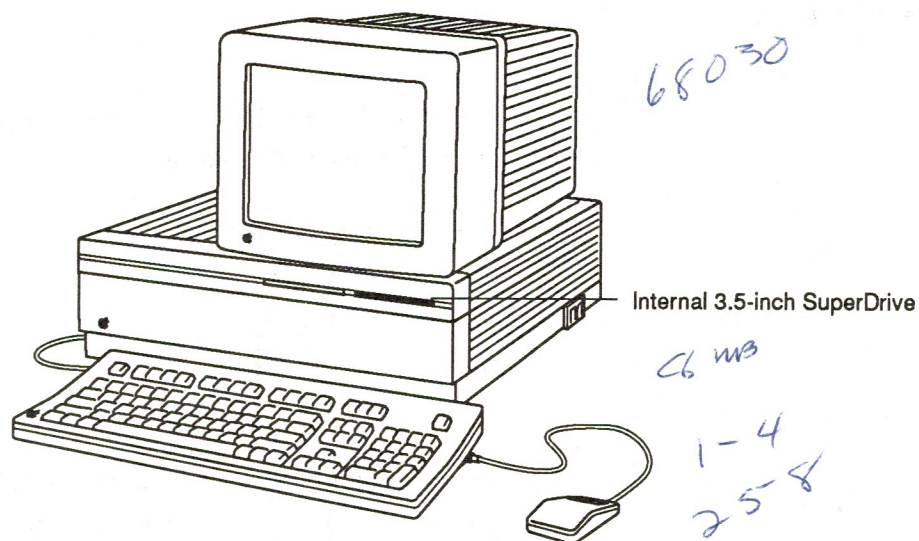


- One internal FDHD/SuperDrive and a 40, 80, or 160 MB internal SCSI hard disk



- Two internal FDHD/SuperDrive and a 40, 80, or 160 MB internal SCSI hard disk





**Figure 11. The Macintosh IIx**

**Microprocessor**

Unlike the Macintosh II, the Macintosh IIx uses a Motorola MC68030 microprocessor running at 16 MHz, and a Motorola 68882 coprocessor.

The MC68030 microprocessor supports paged memory management, required for multitasking operating systems such as A/UX (UNIX).

**Memory**

RAM

The Macintosh IIx comes with one to four megabytes of RAM. It can be upgraded to two, five or eight megabytes.

ROM

The Macintosh IIx comes with 256K of ROM.

**Expansion Slots**

Like the Macintosh II, the Macintosh IIx has six NuBus slots.

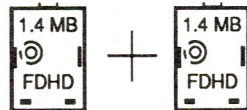
## Macintosh IIfx

### Drive Configuration

The Macintosh IIfx, shown in figure 12, is similar in style to the Macintosh II and IIfx. It comes in the following configurations:

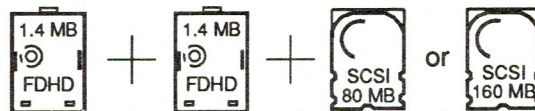
#### Standard

- Two Apple FDHD/SuperDrives

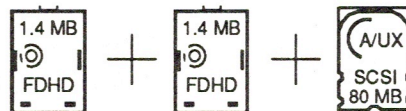


#### Optional

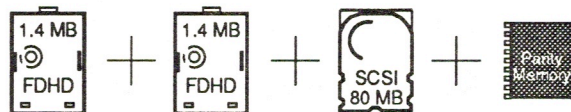
- Two Apple FDHD/SuperDrives and one 80 MB or 160 MB hard disk

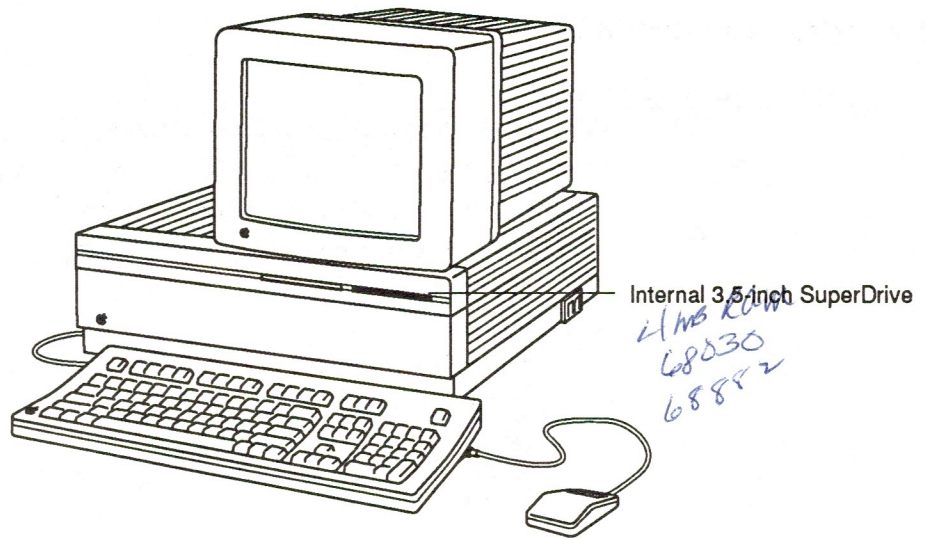


- Two Apple FDHD/SuperDrives and one 80 MB hard disk with Apple A/UX



- Two Apple FDHD/SuperDrives and one 80 MB hard disk and parity memory





**Figure 12. The Macintosh IIfx**

## **Microprocessor**

The Macintosh IIfx uses a Motorola 68030 microprocessor running at 40 MHz, with built-in page memory management unit (PMMU). This unit is 130 to 300 percent faster than the Macintosh IIx and 30 to 80 percent faster than the Macintosh IIfx.

There also is MC 68882 math coprocessor.

## **Memory**

### ROM

Unlike the Macintosh II and Macintosh IIx, the IIfx comes with 512K of ROM.

### RAM

The Macintosh IIfx comes with 4 MB of RAM on four SIMMs (4 x 1MB SIMMs). It can be expanded to 8 MB. Optionally, the system can be configured with 4 MB of 60 nsec parity RAM, which can be expanded to 8 MB.

## **Ports and Connectors**

Ports and connectors on the Macintosh IIfx comprise the following:

- One SCSI port
- Two serial ports
- Two ADB ports
- One stereo sound output port

## **Expansion Ports**

The Macintosh IIfx contains six NuBus slots and one 120-pin processor direct slot used for high-speed interfacing to the microprocessor.

### The Macintosh IIcx and the IIci

#### *Drive Configuration*

The Macintosh IIcx (shown in figure 13) and the Macintosh IIci are exactly the same in appearance and have smaller dimensions than the Macintosh II, Macintosh IIfx, and Macintosh IIfx. The Macintosh IIcx and Macintosh IIci have the same drive configurations, which are:

#### Standard

One FDHD/SuperDrive



#### Optional

One FDHD/SuperDrive and one 40 MB or 80 MB SCSI hard disk

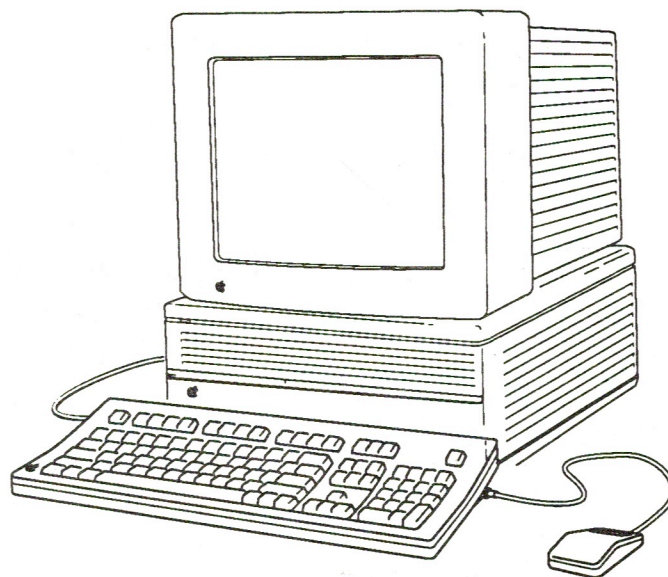


Figure 13. The Macintosh IIcx/IIci

### ***Microprocessor***

Both the Macintosh IICx and the Macintosh IICI use a Motorola MC68030 microprocessor and a Motorola 68882 coprocessor. The Macintosh IICx processor runs at 16 MHz. The Macintosh IICI processor runs at 25 MHz.

The MC68030 microprocessor supports paged memory management, required for multitasking operating systems.

### ***Memory***

A primary difference between the Macintosh IICx and the Macintosh IICI is that the Macintosh IICx has 256K of ROM, and the Macintosh IICI has 512K.

### ***Ports and Connectors***

In addition to the standard SCSI, ADB, audio and serial ports, the Macintosh IICx and the Macintosh IICI have an external floppy disk drive connector for connecting an external 800K or SuperDrive. The Macintosh IICI also has a video port. The Macintosh IICI has on-board video support. The Macintosh IICx needs a NuBus card to support video.

### ***Expansion Slots***

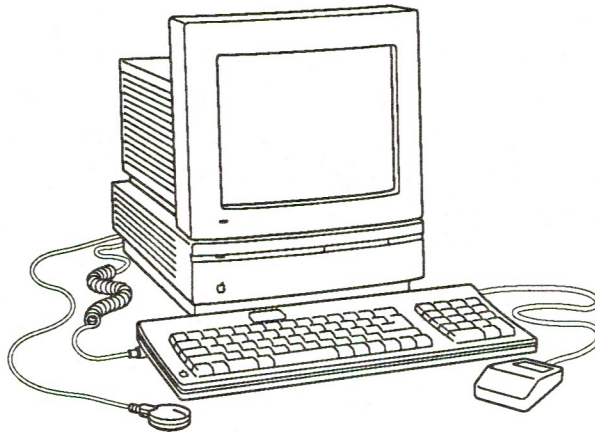
The Macintosh IICx and Macintosh IICI have only three NuBus slots. On the Macintosh IICx one of the slots has to be used for a video card. On the Macintosh IICI, there is built-in video, which supports all the Apple monitors except the Apple Two-Page monitor. A video card is needed only to support the Apple Two-Page monitor.

### Macintosh IIsi

#### *Drive configuration*

There are two configurations for the Macintosh IIsi shown in figure 14.

- One Apple FDHD/SuperDrive and one 1-inch high 40 MB hard drive
- One Apple FDHD/SuperDrive and one 1-inch high 80 MB hard drive



**Figure 14. Macintosh IIsi**

#### *Microprocessor*

The Macintosh IIsi uses a Motorola 68030 microprocessor running at 20 MHz. An optional 20 MHz MC68882 FPU coprocessor can be used on an optional adapter card. (See Expansion Ports later in this section.)

#### *Memory*

##### ROM

The Macintosh IIsi comes with 512K of ROM.

##### RAM

The Macintosh IIsi comes with two megabytes of RAM, 1 MB soldered in on the main logic board and 1 MB on four SIMMs (4, 256K SIMMs). It can be expanded to 5 MB by replacing the 256K SIMMs with 1 MB SIMMs in the four SIMM sockets.

### ***Ports and Connectors***

Ports and connectors on the Macintosh IIx comprise the following:

- One SCSI port
- One external floppy drive port (FDHD or 800K drive)
- Two serial ports
- One video output port that supports the following monitors:
  - Macintosh 12-inch RGB Display
  - Apple High-Resolution monochrome monitor
  - AppleColor High-Resolution RGB monitor
  - Macintosh Portrait Display
  - Macintosh 12-inch Monochrome Display monitor
- One ADB port
- One stereo sound output port
- One monaural sound input port

### ***Expansion Ports***

The Macintosh IIx contains one slot that accepts an Apple adapter card, of which there are two types. One accommodates a NuBus expansion card, such as a video card, and the other adapter card accepts 030 Direct Slot expansion cards.

### ***Video***

The Macintosh IIx contains built-in video that supports the monitors listed above under Ports and Connectors. For monitors that are not supported with the built-in video, a video card can be used in the expansion slot.

## Macintosh LC

### Drive Configuration

The standard configuration for the Macintosh LC (Figure 15, next page) is one internal 1.4 MB Apple SuperDrive (FDHD). Optional configurations for the Macintosh LC include:

#### Standard

- One Apple FDHD/SuperDrive



#### Optional

- One Apple FDHD/SuperDrive and one 3.5-inch diameter by 1-inch high internal 40MB SCSI hard disk



- Two FDHD/SuperDrives.

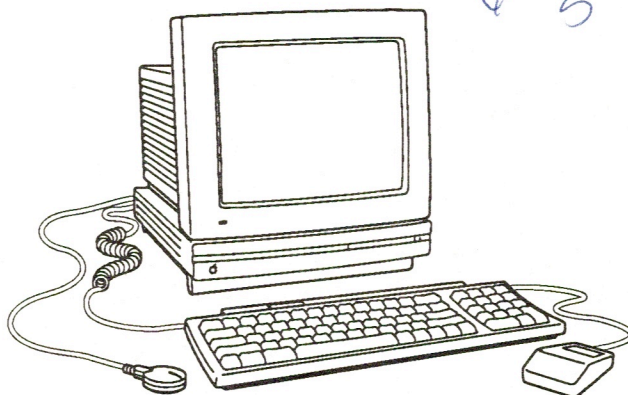
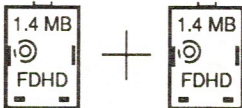


Figure 15. Macintosh LC

***Microprocessor***

The Macintosh LC uses a Motorola 68020 microprocessor running at 16 MHz. The LC does not have a coprocessor.

***Memory***

ROM

Like the IIci and IIsi, the LC comes with 512K of ROM.

RAM

Standard for the Macintosh LC, is 2 MB soldered in on the main logic board. It can be upgraded to 4 MB (two 1 MB memory SIMM boards), which can be installed in two SIMM slots.

VRAM (video RAM)

256K VRAM on a SIMM board is standard in the Macintosh LC for supporting the on-board video. There is an optional 512K VRAM SIMM that can replace the 256K SIMM, to extend the number of colors or shades of gray that can be displayed.

***Ports and Connectors***

Ports and connectors on the Macintosh LC comprise the following:

- One SCSI port
- Two serial ports
- One video output port that supports the following:
  - Macintosh 12-inch RGB display monitor at 8 bits/pixel with 256K VRAM
  - Apple High-Resolution monochrome monitor
  - AppleColor High-Resolution RGB monitor
  - Macintosh 12-inch Monochrome Display monitor at 4 bits/pixel with 256K VRAM
- One ADB port, for use with the Apple Keyboard, Apple Keyboard II, or the Apple Extended Keyboard II
- One monaural output sound port
- One monaural sound input port

***Expansion Ports***

The Macintosh LC contains one 020 processor Direct slot option. This is a 96-pin slot that accepts a variety of compatible expansion cards. Currently the Ethernet and Apple II emulator cards are available from Apple.

**Continue with the next section, Exercise: Modular Macintosh Computers.**

# Exercise: Modular Macintosh Computers

## Directions

Answer questions 1 through 6 by circling the letters that correspond to all correct answers:

1. Which of the following are standard Macintosh II drive configurations?
  - ☒ A. Two internal 800K 3.5-inch disk drives
  - ☒ B. One internal 800K 3.5-inch disk drive and one SuperDrive
  - ☒ C. One internal 80 MB SCSI hard disk and one internal 40 MB SCSI hard disk
  - ☒ D. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk
  - ☐ E. One internal 800K 3.5-inch disk drive and one internal 160 MB SCSI hard disk
2. Which of the following are Macintosh IIx drive configurations?
  - ☐ A. Two internal 800K 3.5-inch disk drives
  - ☐ B. One internal 400K 3.5-inch disk drive and one SuperDrive
  - ☐ C. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk
  - ☒ D. One FDHD/SuperDrive and one internal 40 MB SCSI hard disk
  - ☒ E. One FDHD/SuperDrive and one internal 160 MB SCSI hard disk
3. Which of the following are Macintosh IICx and Macintosh IICI drive configurations?
  - ☐ A. Two internal 800K 3.5-inch disk drives
  - ☐ B. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk drive
  - ☐ C. One internal 800K 3.5-inch disk drive and one FDHD/SuperDrive
  - ☒ D. One FDHD/SuperDrive and one internal 80 MB SCSI hard disk
  - ☒ E. One FDHD/SuperDrive and one internal 40 MB SCSI hard disk
4. Which of the following are Macintosh IIfx drive configurations?
  - ☐ A. Two internal 800K 3.5-inch disk drives
  - ☒ B. Two FDHD/SuperDrive
  - ☐ C. One FDHD/SuperDrive and one internal 40 MB SCSI hard disk
  - ☒ D. Two FDHD/SuperDrives and one internal 80 MB SCSI hard disk
  - ☒ E. Two FDHD/SuperDrives and one internal 80 MB A/UX SCSI hard disk

5. Which of the following are Macintosh IIsi drive configurations?
- ✓ A. One FDHD/SuperDrive
  - B. Two FDHD/SuperDrives
  - ✓ C. One FDHD/SuperDrive and one internal 40 MB SCSI hard disk
  - D. Two FDHD/SuperDrives and one internal 40 MB SCSI hard disk
  - ✓ E. One FDHD/SuperDrive and one internal 80 MB SCSI hard disk
6. Which of the following are Macintosh LC drive configurations?
- ✓ A. One FDHD/SuperDrive
  - ✓ B. Two FDHD/SuperDrives
  - C. One FDHD/SuperDrive and one internal 80 MB SCSI hard disk
  - ✓ D. One FDHD/SuperDrive and one internal 1-inch high 40 MB SCSI hard disk
  - E. Two FDHD/SuperDrives and one internal 40 MB SCSI hard disk
7. By adding the currently available 1 MB SIMMs, what is the maximum amount of RAM that you can install in each of the following:
- a. Macintosh II 8 MB
  - b. Macintosh IIX 6 MB
  - c. Macintosh IICX 6 MB
  - d. Macintosh IICI 6 MB
  - e. Macintosh IIFX 4 MB
  - f. Macintosh IISI 5 MB
  - g. Macintosh LC 4 MB
8. How much ROM does each of the following computers have?
- a. Macintosh II 256 K
  - b. Macintosh IIX 256 K
  - c. Macintosh IICX 256 K
  - d. Macintosh IICI 512 K
  - e. Macintosh IIFX 512 K
  - f. Macintosh IISI 512 K
  - g. Macintosh LC 512 K

## EXERCISE: MODULAR MACINTOSH COMPUTERS

9. Here is a list of Apple monitors. Indicate which modular Macintosh is compatible with each monitor by checking the spaces corresponding to the computers. (Assume the monitor includes a video card if necessary).

	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a. Apple High-Resolution Monochrome	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
b. AppleColor High-Resolution RGB	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
c. Apple Macintosh Portrait Display	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
d. Apple Two-Page Monochrome	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
e. Macintosh 12-inch Monochrome	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
f. Macintosh 12-inch RGB Display	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

10. Here is a list of features. Indicate which feature is standard with each Macintosh by checking the spaces provided.

	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a. Two ADB ports	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
b. MC68020 microprocessor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
c. MC68030 microprocessor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
d. Paged memory management	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
e. 68881 coprocessor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
f. 68882 coprocessor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
g. One ADB port	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
h. 3 NuBus slots	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
i. 6 NuBus slots	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
j. SCSI port	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
k. On-board video	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
l. 020 Direct Slot	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
m. Adapter card	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Compare your answers to those provided on the following pages.

## Exercise: Modular Macintosh Computers (Answers)

Compare your answers to the ones below:

1. A, D, E
2. D, E
3. D and E
4. B, D, and E
5. A, C, and E
6. A, B, and D
7. Macintosh II, 8 MB  
Macintosh IIx, 8 MB  
Macintosh IICx, 8 MB  
Macintosh IICi, 8 MB  
Macintosh IIfx, 8 MB  
Macintosh IISI, 5 MB  
Macintosh LC, 4 MB
8. Macintosh II, 256K  
Macintosh IIx, 256K  
Macintosh IICx, 256K  
Macintosh IICi, 512K  
Macintosh IIfx, 512K  
Macintosh IISI, 512K  
Macintosh LC, 512K

9.	II	IIx	IICx	IICi	IIfx	IISI	LC
a. Apple High-Resolution Monochrome	x	x	x	x	x	x	x
b. AppleColor High-Resolution RGB	x	x	x	x	x	x	x
c. Apple Macintosh Portrait Display	x	x	x	x	x	x	
d. Apple Two-Page Monochrome	x	x	x	x	x	x	
e. Macintosh 12-inch Monochrome	x	x	x	x	x	x	x
f. Macintosh 12-inch RGB Display	x	x	x	x	x	x	x

## EXERCISE: MODULAR MACINTOSH COMPUTERS(ANSWERS)

10.	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a. Two ADB ports	X	X	X	X	X	—	—
b. MC68020 microprocessor	X	—	—	—	—	X	—
c. MC68030 microprocessor	X	X	X	X	X	—	—
d. Paged memory management	X	X	X	X	X	—	—
e. 68881 coprocessor	X	—	—	—	—	—	—
f. 68882 coprocessor	—	X	X	X	—	—	—
g. 3 NuBus slots	—	—	X	X	—	—	—
h. 6 NuBus slots	X	X	—	—	X	—	—
i. SCSI port	X	X	X	X	X	X	X
j. On-board video	—	—	—	X	—	X	X
k. One ADB port	—	—	—	—	—	X	X
l. 020 Direct Slot	—	—	—	—	—	—	X
m. 030 Direct Slot	—	—	—	—	—	X	—

If you had difficulty with any of the items on this exercise, review Modular Macintosh Features and Configurations.

Continue with the next section, Module Summary.

# Module Summary

Use the charts on the following three pages as a module summary and quick reference guide. The first page is a chart for the compact Macintosh computers, the next page contains a chart for the module Macintosh computers, and the third page contains a chart for monitor and computer compatibility.

	Macintosh Plus	Macintosh SE	Macintosh SE/30	Macintosh Classic
<b>Drive Configurations</b>	Standard: One internal 3.5", 800K drive	Standard: One FDHD drive Optional: Two FDHD drives; One FDHD drive and one 20MB or 40MB HD	Standard: One FDHD & one internal 40MB or 80MB HD	Standard: One internal FDHD and one internal 40 MB HD
<b>Microprocessor</b>	MC 68000 at 8 mHZ	MC 68000 at 8 mHZ	MC 68030 at 16 mHZ – Supports page memory management – 68882 Coprocessor	MC 68000 at 8 mHZ
<b>RAM Memory</b>	Standard: 1MB Upgrade to 2.5MB or 4MB –SIMMs	Standard: 1MB or 2MB Upgrade to 2, 2.5, or 4MB – SIMMs	Standard: 1MB or 4MB Upgrade to 2, 4, 5, or 8MB – SIMMs	Standard: 1 MB soldered in Upgrades: 1MB on memory expansion board, soldered in, can be expanded to 2.5 MB or 4MB with SIMMs on board.
<b>ROM Memory</b>	128K	256K	256K	512K
<b>Ports and Connectors</b>	1 SCSI port 2 Serial ports 1 External floppy disk port 1 Mono audio jack 1 Mouse port	1 SCSI port 2 Serial ports 1 External floppy disk port 1 Mono audio jack 1 Mouse port	1 SCSI port 2 Serial ports 1 External floppy disk port 1 Stereo audio jack 1 Mouse port	1 SCSI port 2 Serial ports 1 External FDHD floppy disk port 1 Stereo audio jack 1 Mouse port
<b>Expansion Slot</b>	N/A	One slot	One slot	Memory expansion slot only
<b>Keyboards</b>	Macintosh Plus Keyboard	The ADB Apple Keyboard or the Apple Extended Keyboard	The ADB Apple Keyboard or the Apple Extended Keyboard	The ADB Apple Keyboard or the Apple Extended Keyboard

	Macintosh II	Macintosh IIfx	Macintosh IIfx	Macintosh IIfx / IIci	Macintosh IISI	Macintosh LC
<b>Drive Configurations</b>	Standard: One internal 3.5", 800K drive Optional: Two internal 800K drives – One internal 800K drive & one FDHD – One internal 800K and one internal 40, 80, or 160 MB HD (SCSI)	Standard: One FDHD drive Optional: Two FDHD drives – One FDHD drive and one 40, 80, or 160MB HD (SCSI) – Two FDHD drives & a 40 or 80MB HD (SCSI)	Standard: Two FDHD drives Optional: Two FDHD and either an 80 or 160 MB HD (SCSI) - Two FDHD and an 80 MB A/UX HD (SCSI)	Standard: One FDHD & one internal 40MB or 80MB HD (SCSI)	Standard: One internal FDHD & one internal 40 or 80 HD (SCSI)	Standard: One internal FDHD Optional: One internal FDHD and one 40 MB 1" high HD (SCSI) - Two FDHD drives
<b>Micro-processor</b>	MC 68020 at 16 MHz – 68881 Coprocessor – Optional MC68851 PMMU unit	MC 68030 at 16 MHz – 68882 Coprocessor	MC 68030 at 40 MHz - with built-in page memory management unit - 68882 Coprocessor	MC 68030 at 16 MHz – 68882 Coprocessor	MC 68030 at 20 MHz – Optional 68882 Coprocessor on adapter card	MC 68020 at 16 MHz
<b>RAM Memory</b>	Standard: 1 or 4MB Upgrade to 4, 5, or 8MB (SIMMs)	Standard: 1 or 4MB Upgrade to 4, 5, or 8MB (SIMMs)	Standard: 4MB Upgrade to 8MB (SIMMs)	Standard: 1 or 4MB Upgrade to 4, 5, or 8MB (SIMMs)	Standard: 2 MB- 1 MB soldered on logic board 1MB in SIMM sockets – Upgrade to 5 MB (SIMMs)	Standard: 2MB soldered on logic board – Upgrade to 4MB with 2 SIMMs slots
<b>ROM Memory</b>	256K	256K	512K	256K on cx 512K on ci	512K	512K
<b>Ports and Connectors</b>	1 SCSI port 2 Serial ports 2 ADB ports 1 Stereo output jack	1 SCSI port 2 Serial ports 2 ADB ports 1 Stereo output jack	1 SCSI port 2 Serial ports 2 ADB ports 1 Stereo output jack	1 SCSI port 2 Serial ports 2 ADB ports 1 Stereo output jack 1 External disk drive port 1 Video output, IIci only	1 Stereo output port – Sound input port – SCSI port – 1 external disk drive port – Serial ports – 1 video output port – 1 ADB port	1 Mono output port – Sound input port – SCSI port 2 Serial ports 1 Video output port – ADB ports
<b>Expansion Slot</b>	Six NuBus slots – One slot to be use for video card	Six NuBus slots – One slot to be use for video card	Six NuBus slots – One slot to be use for video card	Three NuBus slots – On IIfx, one slot is used for video card. Video card is optional on IIci	One slot for two optional types of adapter cards – One supports a NuBus expansion card – the other supports the 030 Direct Slot expansion card	One 020 direct drive slot
<b>Key Boards</b>	ADB Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II	ADB Apple Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II	ADB Apple Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II	ADB Apple Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II	ADB Apple Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II	ADB Apple Keyboard - Apple Keyboard II - Apple Extended Keyboard - Apple Extended Keyboard II

The next chart is a compatibility guide between the modular Macintosh computers and the available Apple monitors. The guide shows two basic groups, computers that need a video card to support video, and the computers that have built-in video support.

Module Macintosh and Monitor Compatibility Chart	Needs Video Card						Built-In Video
	Macintosh II	Macintosh IIfx	Macintosh IIfx	Macintosh IIfx	Macintosh IIfx	Macintosh IIfx	Macintosh LC
Apple High-Res. Mono	X	X	X	X	X	X	X
Mac 12-inch Mono Display	X	X	X	X	X	X	X
Apple Color High-Res. RGB	X	X	X	X	X	X	X
Mac 12-inch RGB Display	X	X	X	X	X	X	X
Apple Mac Portrait Display	X	X	X	X	X	X	
Apple Two-Page Mono	X	X	X	X	X VC	X VC	

X = Compatible

VC = Video Card Needed

You have now completed this module.

Check your skills and knowledge against the Skills Checklist. When you are ready, take the Module Test.

# Module Test

For items 1 through 10, check all correct answers.

1. Which of the following are Macintosh Plus drive configurations?

- ☐ a. One internal 400K 3.5-inch disk drive
- ☒ b. One internal 800K 3.5-inch disk drive
- ☐ c. Two internal 800K 3.5-inch disk drives
- ☐ d. One internal 400K 3.5-inch disk drive and one internal 40 MB SCSI hard disk
- ☐ e. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk

2. Which of the following are Macintosh SE drive configurations?

- ☐ a. Two internal 400K 3.5-inch disk drives
- ☐ b. Two internal 800K 3.5-inch disk drives
- ☐ c. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk
- ☐ d. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk
- ☒ e. One internal Apple SuperDrive and one internal 40 MB SCSI hard disk
- ☒ f. Two internal Apple SuperDrives

3. Which of the following are Macintosh SE/30 drive configurations?

- ☒ a. One internal 800K 3.5-inch disk drive and one internal 40 MB SCSI hard disk drive
- ☐ b. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk drive
- ☐ c. One internal 800K 3.5-inch disk drive and one internal SuperDrive
- ☒ d. One SuperDrive and one internal 40 MB SCSI hard disk
- ☒ e. One SuperDrive and one internal 80 MB SCSI hard disk

4. Which of the following configurations does Apple currently offer for the Classic?

- ☐ a. One internal SuperDrive
- ☐ b. Two internal SuperDrives
- ☒ c. One internal SuperDrive and one internal 40 MB SCSI hard disk
- ☐ d. One internal SuperDrive and one internal 80 MB SCSI hard disk
- ☐ e. Two internal SuperDrives and one internal 40 MB SCSI hard disk

5. Which of the following are Macintosh II drive configurations?

- ☒ a. Two internal 800K 3.5-inch disk drives
- ☒ b. One internal 800K 3.5-inch disk drive and one internal 80 MB SCSI hard disk
- ☒ c. One internal 800K 3.5-inch disk drive and one internal FDHD/SuperDrive
- ☐ d. One internal 20 MB SCSI hard disk and one internal 80 MB SCSI hard disk
- ☐ e. One internal 400K 3.5-inch drive and one internal 160 MB SCSI hard disk

6. Which of the following are Macintosh IIfx drive configurations?

- ☐ a. Two internal 800K 3.5-inch disk drives
- ☒ b. Two internal FDHD/SuperDrives
- ☐ c. One internal 800K 3.5-inch disk drive and one internal FDHD/SuperDrive
- ☒ d. One internal FDHD/SuperDrive and one internal 80 MB SCSI hard disk
- ☒ e. One internal FDHD/SuperDrive and one internal 160 MB SCSI hard disk

7. Which of the following are Macintosh IIfx drive configurations?

- ☐ a. Two internal 800K 3.5-inch disk drives
- ☒ b. Two Apple FDHD/SuperDrives
- ☐ c. One Apple FDHD/SuperDrive and one internal 40 MB SCSI hard disk
- ☒ d. Two Apple FDHD/SuperDrives and one internal 80 MB SCSI hard disk
- ☒ e. Two Apple FDHD/SuperDrives and one internal 80 MB A/UX SCSI hard disk

8. Which of the following are Macintosh IICx or Macintosh IICi drive configurations?

- ☐ a. Two internal 800K 3.5-inch disk drives
- ☐ b. Two internal FDHD/SuperDrives
- ☐ c. One internal 800K 3.5-inch disk drive and one internal FDHD/SuperDrive
- ☒ d. One internal FDHD/SuperDrive and one internal 80 MB SCSI hard disk
- ☐ e. One internal 40 MB SCSI hard disk and one internal 80 MB SCSI hard disk

9. Which of the following are Macintosh IISI drive configurations?

- ☐ a. One Apple FDHD/SuperDrive
- ☐ b. Two Apple FDHD/SuperDrives
- ☒ c. One Apple FDHD/SuperDrive and one internal 40 MB SCSI hard disk
- ☐ d. Two Apple FDHD/SuperDrives and one internal 40 MB SCSI hard disk
- ☒ e. One Apple FDHD/SuperDrive and one internal 80 MB SCSI hard disk

10. Which of the following are Macintosh LC drive configurations?

- ☒ a. One Apple FDHD/SuperDrive
- ☒ b. Two Apple FDHD/SuperDrives
- ☐ c. One Apple FDHD/SuperDrive and one internal 80 MB SCSI hard disk
- ☒ d. One Apple FDHD/SuperDrive and one internal 1-inch high 40 MB SCSI hard disk
- ☐ e. Two Apple FDHD/SuperDrives and one internal 40 MB SCSI hard disk

11. What is the maximum amount of RAM that the following can have without memory expansion cards? Write the answers in the spaces provided.

Macintosh Plus	<u>4</u> MB	Macintosh II	<u>6</u> MB
Macintosh SE	<u>4</u> MB	Macintosh IIX	<u>6</u> MB
Macintosh SE/30	<u>8</u> MB	Macintosh IICx	<u>26</u> MB
Macintosh Classic	<u>4</u> MB	Macintosh IICi	<u>8</u> MB
		Macintosh IIfx	<u>8</u> MB
		Macintosh IISI	<u>5</u> MB
		Macintosh LC	<u>2</u> MB

12. How much ROM does each of the following computers come with?

Macintosh Plus	<u>128</u> K	Macintosh II	<u>256</u> K
Macintosh SE	<u>256</u> K	Macintosh IIfx	<u>256</u> K
Macintosh SE/30	<u>256</u> K	Macintosh IICx	<u>256</u> K
Macintosh Classic	<u>512</u> K	Macintosh IICI	<u>512</u> K
		Macintosh IIfx	<u>512</u> K
		Macintosh IISI	<u>512</u> K
		Macintosh LC	<u>510</u> K

13. Which of the following does the ADB support? Check all correct answers.

- ☒ a. mouse
- ☐ b. external hard disk
- ☐ c. monitor
- ☒ d. keyboard

14. Here is a list of features. Indicate each feature that is part of each computer's standard system configuration by placing an X in the appropriate column.

	Plus	SE	SE/30	Classic	II	IIfx	IICx	IICI	IIfx	IISI	LC
a. MC68000 microprocessor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. MC68020 microprocessor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
c. MC68030 microprocessor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
d. 68882 coprocessor	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
e. (standard) paged memory management	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

15. Here is another list of features. Indicate each feature that is part of each computer's basic system configuration by placing an X in the appropriate column.

	Plus	SE	SE/30	Classic	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a. 3 NuBus slots	—	—	—	—	—	—	✓	✓	—	—	—
b. 6 NuBus slots	—	—	—	—	✓	✓	—	—	✓	—	—
c. ADB	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
d. SCSI port	—	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
e. 1 expansion slot	—	✓	✓	✓	—	—	—	—	—	✓	✓
f. On-board video	—	—	—	—	—	—	—	✓	—	✓	✓

16. Here is a list of Apple monitors. (Assume the monitors include a video card when necessary.) Indicate which modular Macintosh is compatible with each monitor by checking the spaces corresponding to the computers.

	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a. Apple High-Resolution Monochrome	—	—	—	—	—	—	—
b. AppleColor High-Resolution RGB	—	—	—	—	—	—	—
c. Apple Macintosh Portrait Display	—	—	—	—	—	—	✓
d. Apple Two-Page Monochrome	—	—	—	—	—	—	✓
e. Macintosh 12-inch Monochrome	—	—	—	—	—	—	—
f. Macintosh 12-inch RGB Display	—	—	—	—	—	—	—

Compare your answers on this test to those provided on the following pages.

---

## Module Test (Answers)

1. b
2. e and f
3. d and e
4. c
5. a, b, and c
6. b, d, and e
7. b, d, and e
8. d
9. c and e
10. a, b, and d

11. Macintosh Plus	<u>4 MB</u>	Macintosh II	<u>8 MB</u>
Macintosh SE	<u>4 MB</u>	Macintosh IIfx	<u>8 MB</u>
Macintosh SE/30	<u>8 MB</u>	Macintosh IICx	<u>8 MB</u>
Macintosh Classic	<u>4 MB</u>	Macintosh IICI	<u>8 MB</u>
		Macintosh IIfx	<u>8 MB</u>
		Macintosh IISI	<u>5 MB</u>
		Macintosh LC	<u>2 MB</u>

12. Macintosh Plus	<u>128 K</u>	Macintosh II	<u>256 K</u>
Macintosh SE	<u>256 K</u>	Macintosh IIfx	<u>256 K</u>
Macintosh SE/30	<u>256 K</u>	Macintosh IICx	<u>256 K</u>
Macintosh Classic	<u>512 K</u>	Macintosh IICI	<u>512 K</u>
		Macintosh IIfx	<u>512 K</u>
		Macintosh IISI	<u>512 K</u>
		Macintosh LC	<u>512 K</u>

13. A and D

14.		Plus	SE	SE/30	Classic	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a.	MC68000 microprocessor	X	X	—	X	—	—	—	—	—	—	—
b.	MC68020 microprocessor	—	—	—	—	X	—	—	—	—	—	X
c.	MC68030 microprocessor	—	—	X	—	—	X	X	X	X	X	—
d.	68882 coprocessor	—	—	X	—	—	X	X	X	X	—	—
e.	Paged memory management	—	—	X	—	—	X	X	X	X	X	—

15.		Plus	SE	SE/30	Classic	II	IIx	IIcx	IIci	IIfx	IIsi	LC
a.	3 NuBus slots	—	—	—	—	—	—	X	X	—	—	—
b.	6 NuBus slots	—	—	—	—	X	X	—	—	X	—	—
c.	ADB	—	X	X	X	X	X	X	X	X	X	X
d.	SCSI	X	X	X	X	X	X	X	X	X	X	X
e.	1 expansion slot	—	X	X	X	—	—	—	—	—	X	X
f.	On-board video	—	—	—	—	—	—	—	X	—	X	X

16.		II	IIx	IIcx	IIci	IIfx	IIsi	LC
a.	Apple High-Resolution Monochrome	X	X	X	X	X	X	X
b.	AppleColor High-Resolution RGB	X	X	X	X	X	X	X
c.	Apple Macintosh Portrait Display	X	X	X	X	X	X	
d.	Apple Two-Page Monochrome	X	X	X	X	X	X	
e.	Macintosh 12-inch Monochrome	X	X	X	X	X	X	X
f.	Macintosh 12-inch RGB Display	X	X	X	X	X	X	X

**You have completed this module. Check the Skills Checklist to verify that you have acquired the skills and knowledge listed there.**

---

# Macintosh Setup Table of Contents

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# Module Introduction

## Overview

As an Apple Service Technician, you will have to set up Macintosh computers for a variety of reasons:

- When servicing a Macintosh, you may have to set it up to isolate a problem and to test the system.
- You may need to set up a Macintosh for your customers or answer their questions about the procedures.
- You may need to set up a Macintosh for your own use.

This module explains how to set up the basic hardware for compact and modular Macintosh computers. This module does not explain how to configure an internal hard disk. Configuring a hard disk requires familiarity with using the Macintosh, so the configuration procedure will be covered in the module Using Macintosh Computers.

## What You Will Learn

Upon completion of this module, you should be able to:

- Set up a compact Macintosh computer by connecting the power cord, keyboard, and mouse.
- Set up a modular Macintosh computer by connecting the power cord, installing a video card, and connecting the keyboard, mouse, and display monitor.

The Skills Checklist following this Module Introduction lists in detail the skills you will learn in this module.

## How You Will Be Tested

### *The Module Test*

This written test will help you verify that you have achieved the tasks outlined in the Skills Checklist.

### *Prerequisite Exam*

Consisting of hands-on and written items, this test will verify that you have mastered the skills listed above. You will then be ready for the lab part of this course.

Throughout all of the tests and exercises, you will be able to refer to these instructional materials and to other Apple reference materials.

### Prerequisites to this Module

Before beginning this module, you must have satisfactorily completed these modules:

- Welcome to Apple Service
- Understanding ESD
- Macintosh Basic Features

### Materials Provided for this Module

The prerequisite modules provide the following materials for this module:

- This Module Workbook
- The Module Test

### Materials You Need to Provide

To complete this module, you need to provide the following:

- Macintosh SE computer
- Macintosh IIcx computer
- ADB keyboard and keyboard cable
- ADB mouse
- Apple power cable
- Either an Apple High-Resolution Monochrome monitor or an AppleColor High-Resolution RGB monitor
- Macintosh II monitor video cable
- Macintosh II video card
- Monitor power cable

If you have the owner's manuals for the Macintosh SE and the Macintosh IIcx, you may wish to refer to them throughout the hands-on exercises in this module.

### How the Module Is Organized

This module is presented in two parts:

**Part 1: Compact Macintosh Computers** You will learn the general procedures for setting up compact Macintosh computers. You will then practice setting up the Macintosh SE, mouse, and keyboard.

**Part 2: Modular Macintosh Computers** You will learn the general procedures for setting up modular Macintosh computers. You will then practice setting up the Macintosh IIcx system.

Following these two parts is a Module Summary.

Continue with the Skills Checklist on the following pages.

---

# Skills Checklist

## What Is the Skills Checklist?

This is a list of tasks that you should be able to perform at the conclusion of this module. The Prerequisite Exam (written and hands-on) will cover these items.

## How to Use the Checklist

Before starting the module, check the items on this list. If you are confident that you can already perform certain tasks, you may decide to skip those parts of the module. Or you may decide to try the Module Test without going through the module. The Module Test is a written test and, as such, cannot test your ability to set up these computers. Do not skip this module unless you are absolutely certain that you can perform the hands-on tasks listed on page 4.

After completing the module, check this list to make certain that you have mastered all of the skills before you attend the Prerequisite Exam and the lab part of this course. If you feel uncertain about any of these tasks, return to the section indicated, review the information, and repeat the hands-on exercises.

Task	Where the Task is Covered
___1. Describe the general steps for setting up compact Macintosh computers.	Setting Up Compact Macintosh Computers
___2. Identify the external connectors and ports on the compact Macintosh computers.	Setting Up Compact Macintosh Computers
___3. Set up the Macintosh SE by connecting the power cable, keyboard, and mouse.	Exercise: Setting Up the Macintosh SE
___4. Describe the general steps for setting up modular Macintosh computers.	Setting Up Modular Macintosh Computers
___5. Identify the external connectors and ports on the modular Macintosh computers.	Setting Up Modular Macintosh Computers
___6. Set up the Macintosh IICx by connecting the monitor, installing a video card, and connecting the keyboard and mouse.	Exercise: Setting Up the Macintosh IICx
___7. Describe three alternative configurations for connecting the keyboard and mouse to a Macintosh.	Exercise: Setting Up the Macintosh SE
___8. Verify that a Macintosh system is properly set up.	Exercise: Setting Up the Macintosh SE Exercise: Setting Up the Macintosh IICx

Continue with the next section, **Setting Up Compact Macintosh Computers.**

---

# Setting Up Compact Macintosh Computers

## Overview

The procedure for setting up compact Macintosh computers are basically the same for all models. Basic set-up procedures for the Macintosh SE, SE/30, and the Classic are exactly the same. The Macintosh Plus differs slightly because it does not have ADB ports.

This section will describe the general steps for setting up a compact Macintosh computer. Figures in this section identify the external connectors on each of the compact models. In the next section, you will practice setting up a Macintosh SE.

## Care and Handling

The compact Macintosh computers are small enough to be somewhat portable. However, they do contain a picture tube (a cathode ray tube or CRT) and may contain a hard disk. If cracked, the CRT may implode. The optional hard disk is a mechanical device with moving parts. Rough handling such as jarring or bumping, especially while the hard disk is running, can result in a mechanical failure or damage to the information stored on the hard disk. Be extra careful when handling these products.

***Warning: Do not remove the cover of a compact Macintosh computer until you have completed the module CRT Safety and Adjustments in the lab part of this course.***

## General Tasks

When you set up a compact Macintosh computer, you will perform the general tasks described below. Do not perform these tasks now (these steps are listed only as an overview); you will perform them in the next section of this module. At that time, you will be given more detailed directions for performing each task.

1. Carefully unpack the computer equipment. Always save the packing materials. If you ever need to move or ship the system or a similar system, you will use the original materials to protect it.
2. Plug one end of the power cord into the power input on the computer and the other end into a three-hole grounded outlet.
3. Connect the keyboard to the computer.
4. Connect the mouse to the computer.

5. Verify that everything is properly connected.
6. Turn on the system.

### External Ports

On all Macintosh computers you can usually tell which port to use by looking at the icon above each port. Below are the icons associated with each port on the Plus.



Figure 1 shows the locations for the external ports on the Macintosh Plus.

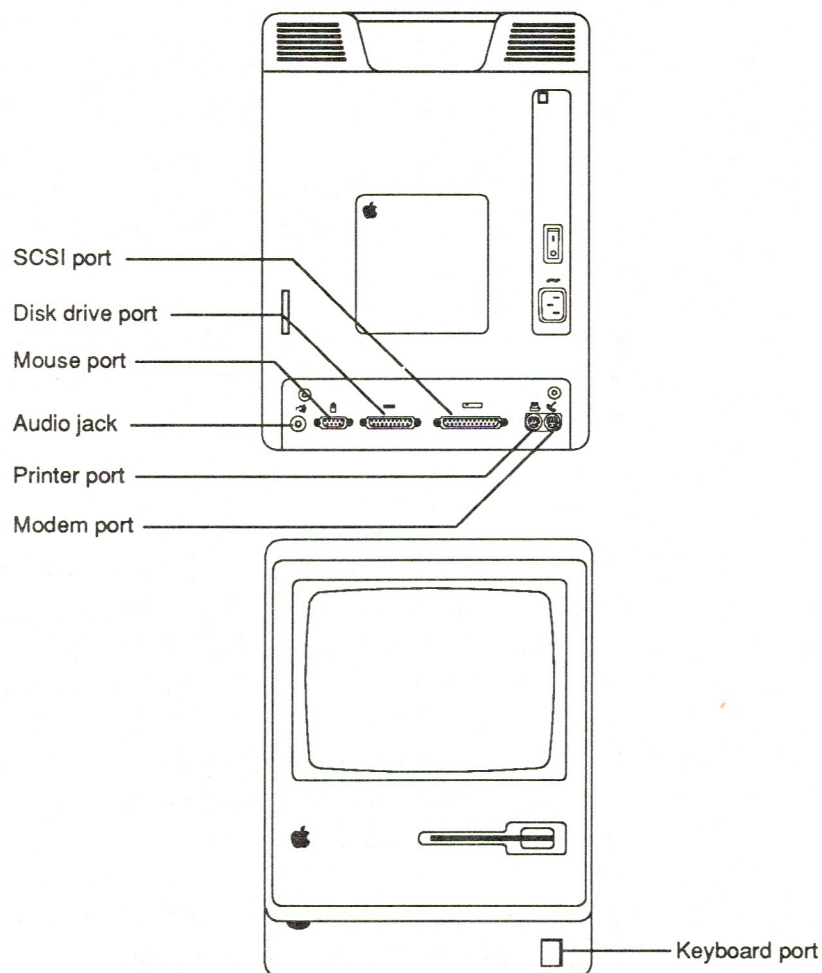
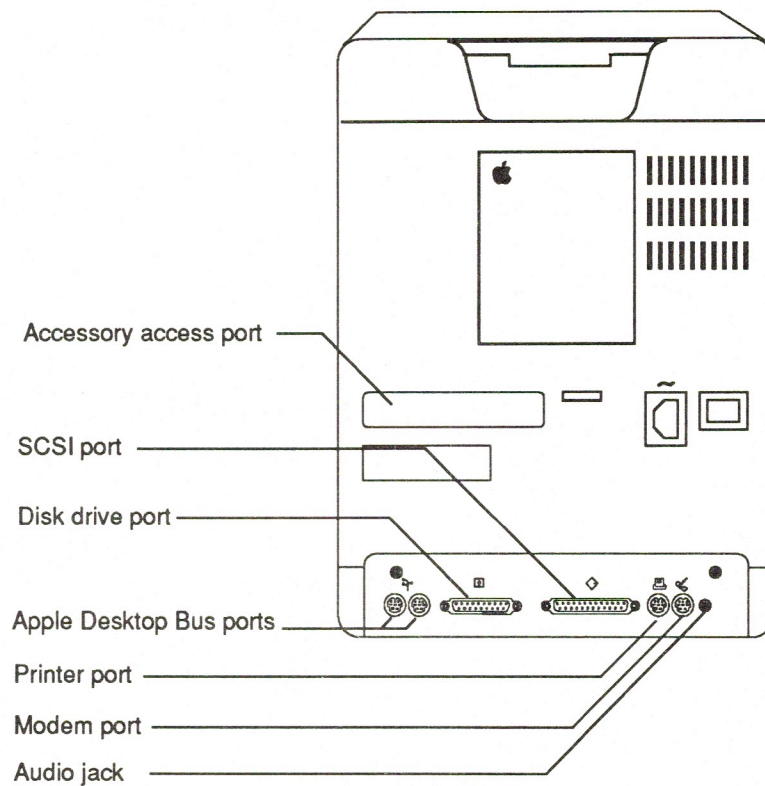


Figure 1. Ports on the Macintosh Plus

The external ports on the SE and the SE/30 are exactly the same. The icons for these ports are shown below.



The port locations on the back panel are shown in Figure 2.

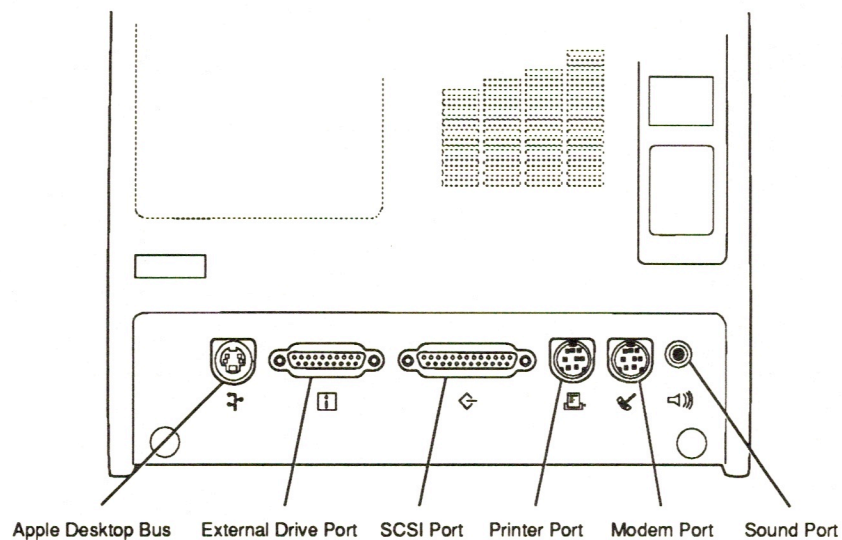


**Figure 2. Ports on the back panel of the Macintosh SE**

The external ports on the Macintosh Classic are similar to those on the SE and SE30 except that the Classic has only one ADB port as shown in the following icons:



Figure 3 shows the port locations for the Macintosh Classic.



**Figure 3. Ports on the back of the Macintosh Classic**

Continue with the next section, Exercise: Setting Up the Macintosh SE.

---

# Exercise: Setting Up the Macintosh SE

## Overview

This exercise will guide you through the steps to set up a Macintosh SE. At the end of this exercise, you will have a functional Macintosh SE that you can work with during the next module, Using Macintosh Computers.

Once you have set up a Macintosh SE in this exercise, you should also be able to set up the other compact models because the set-up procedures are similar.

## What You Will Need

You will need the following materials for this exercise:

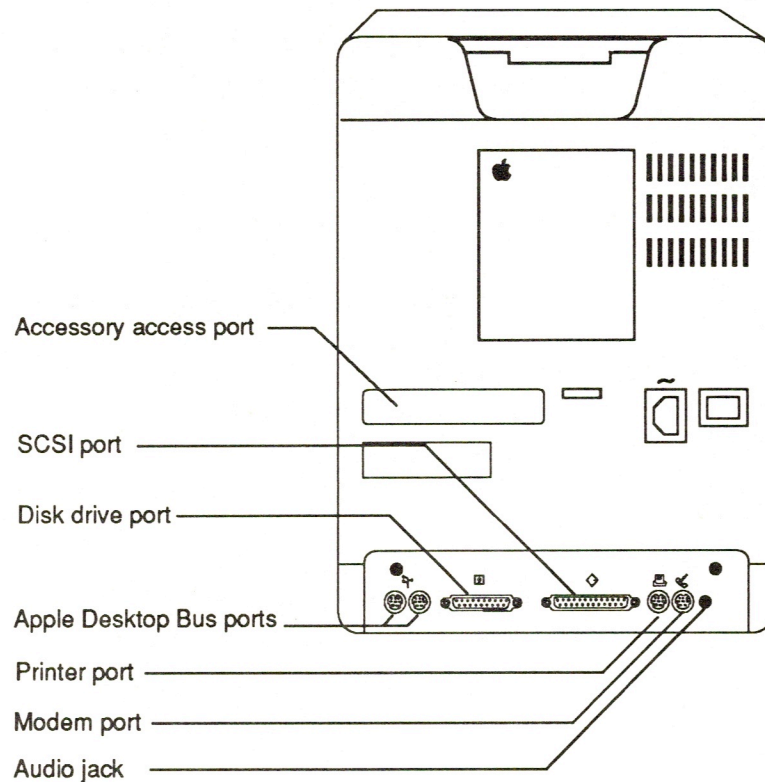
- Macintosh SE. You can use any disk drive configuration.
- ADB mouse
- ADB keyboard
- Apple power cord
- ADB keyboard cable

## Unpacking

If you have not already done so, unpack the computer and the other materials provided in the packing box. Remember to save the packing materials.

### External Ports

Everything you connect to the Macintosh SE attaches to a port on the back panel of the computer, as shown in Figure 4. Locate these ports on your Macintosh SE. Depending on the internal options installed in a system, the accessory access port may look different from the one shown in the figure.



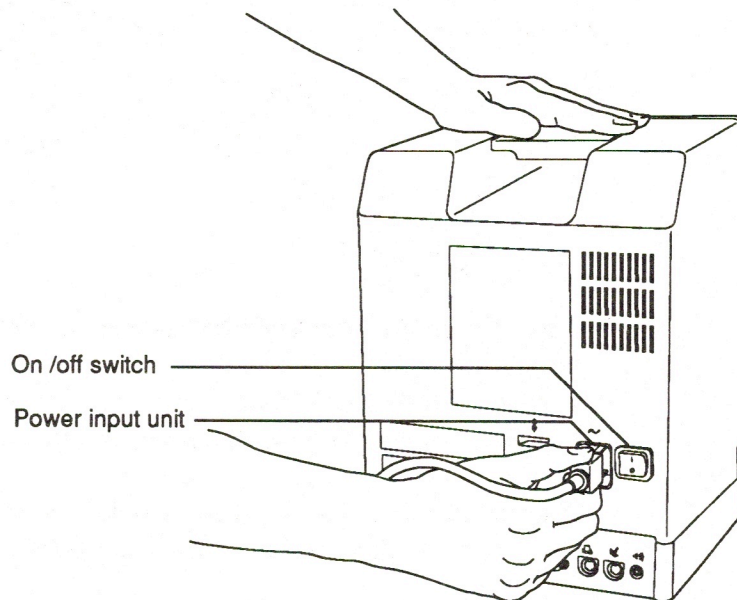
**Figure 4. Ports on the back panel of the Macintosh SE**

## Setting Up the Computer

Follow these steps to set up your system.

### *Power Cord*

1. Plug the power cord into the power input unit, which is next to the power switch on the back of the Macintosh SE, as shown in Figure 5.



**Figure 5. Plugging in the power cord**

2. Plug the other end of the power cord into a three-hole grounded outlet.

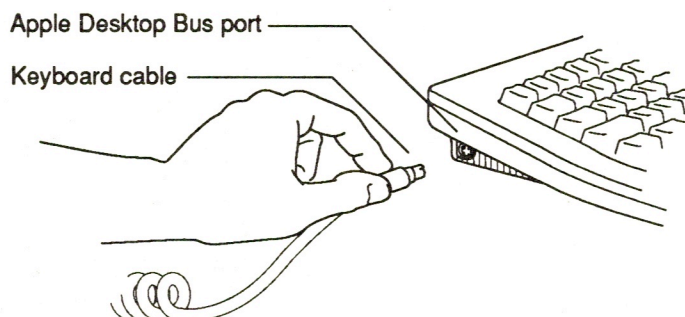
**Warning:** *The three-wire grounding plug is a safety feature. Do not modify it or use an adaptor.*

As you continue to set up the Macintosh SE system, leave the power cord plugged in, but be sure the power switch is turned off. When properly connected to a grounded outlet, the power cord serves to ground the computer electrically, even when the computer is turned off.

### *Keyboard and Mouse*

There are several ways to connect the keyboard and mouse to the computer. The following steps show just one way. When you have completed this procedure, you will learn a few alternative ways.

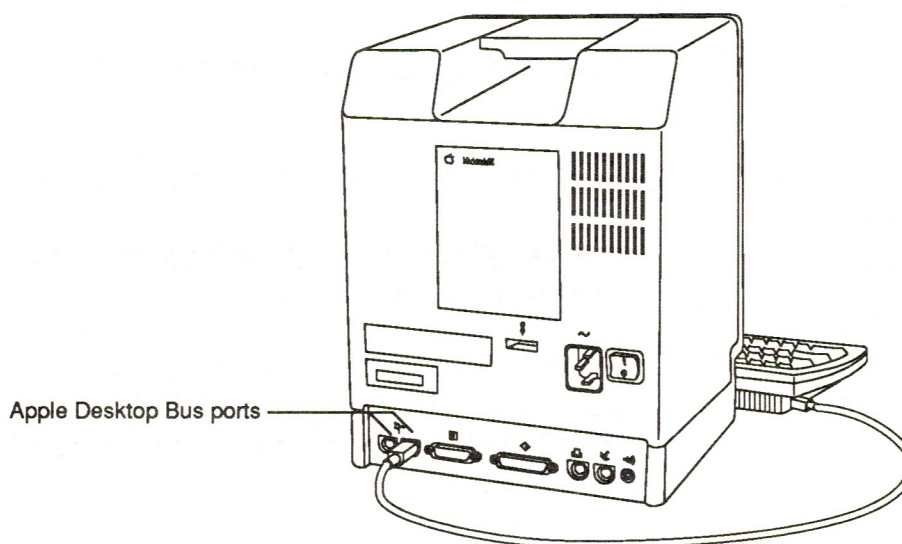
3. With the keyboard facing you, plug one end of the keyboard cable into the ADB port on the left side of the keyboard, as shown in Figure 6.



**Figure 6. Connecting the keyboard cable to the keyboard**

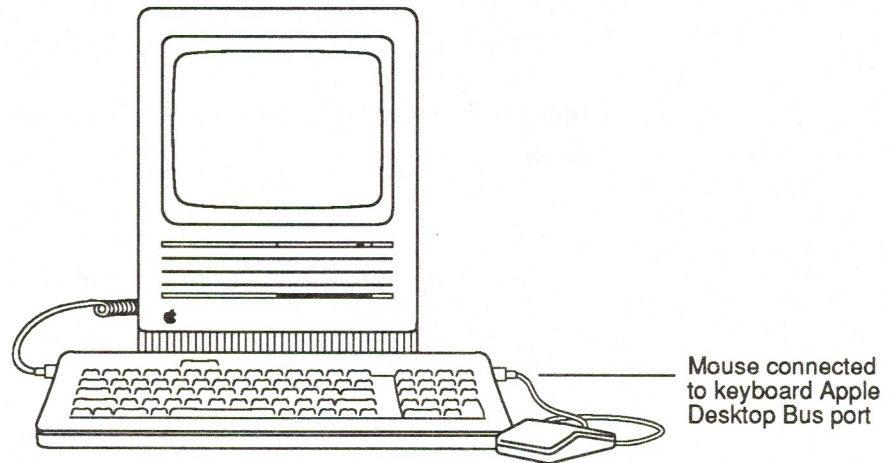
There are several different ADB keyboards. Even though ADB keyboards look different, you connect them all to the computer in the same way.

4. Plug the other end of the keyboard cable into either one of the two ADB ports on the back of the Macintosh SE, as shown in Figure 7.



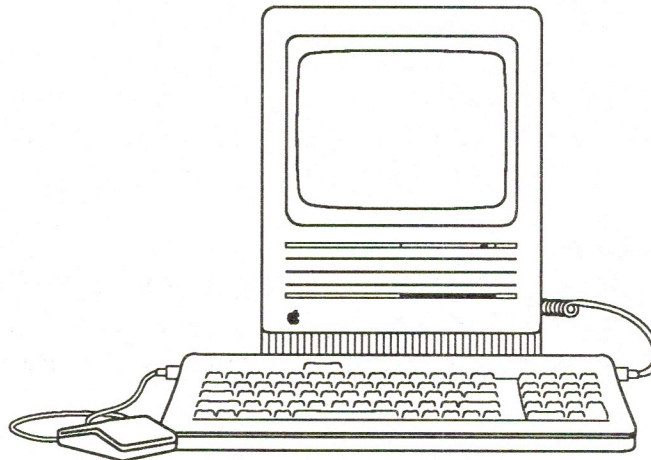
**Figure 7. Connecting the keyboard cable to the computer**

5. Plug the mouse cable into the ADB port on other side of the keyboard, as shown in Figure 8.



**Figure 8. Connecting the mouse to the Macintosh SE**

Figure 9 illustrates how you can reverse the mouse and keyboard cables to accommodate left-handed users.



**Figure 9. Alternative configuration for left-handed users**

Another alternative is to connect the mouse to the other ADB port on the back of the computer.

### Connecting Other ADB Devices

Remember that the keyboard and mouse are just two of the ADB devices that can be connected to these ports. You can add other third-party ADB devices, such as a graphics tablet, a joystick, or another keyboard, to the system by connecting them to the keyboard or to one of the two ADB ports on the back panel of the Macintosh SE.

**Caution:** *Always turn off the system power before you connect or disconnect ADB devices.*

### Turning On the System

6. Verify that the system is properly connected by turning on the power. (The power switch is in the "1" position when on, "0" position when off.) Listen for the "beep" that indicates the system has started.

If this is the first time the system has been turned on, a yellow plastic disk may pop out of each disk drive. Macintosh SE computers with 800K floppy disk drives come with the plastic disks inserted to prevent damage to the disk drives during shipping. Remove the plastic disks and save them for later use.

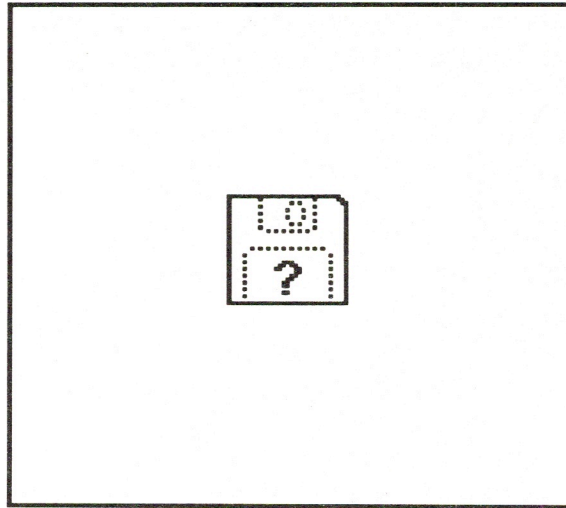
If the floppy disk drive is a 1.4 megabyte FDHD/SuperDrive, then the plastic insert is not installed. Due to the design of the disk head, the plastic insert is not needed. Do not put these plastic inserts into the FDHD/SuperDrive, as the heads will be damaged.

#### ***If It Doesn't Power On***

If the system does not power on, turn off the power switch. Make sure that all of the connections are secure and that your power source is good. Then try to power on the system again. Listen for the beep.

#### ***What You Should See***

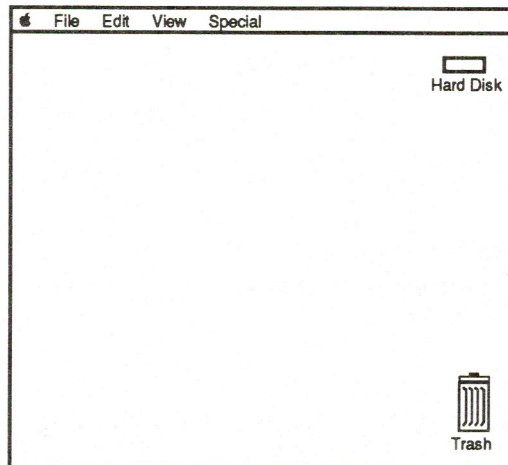
When the system powers up, an icon representing a Macintosh disk should appear on the screen, as shown in Figure 10 on the next page. The blinking question mark shows that the Macintosh SE is ready for you to insert a disk.



**Figure10. Startup screen when no disk is in the system**

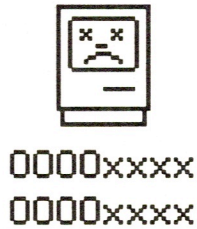
If your screen does not look like the one shown in Figure 10, and your system includes an internal hard disk, the hard disk may already have been configured. In that case, you may see the screen shown in Figure 11.

If the screen continues to display the blinking question mark shown in Figure10, then the hard disk is not configured. See the module Using Macintosh Computers for configuration procedures.



**Figure 11. Screen that appears if the hard disk has been configured**

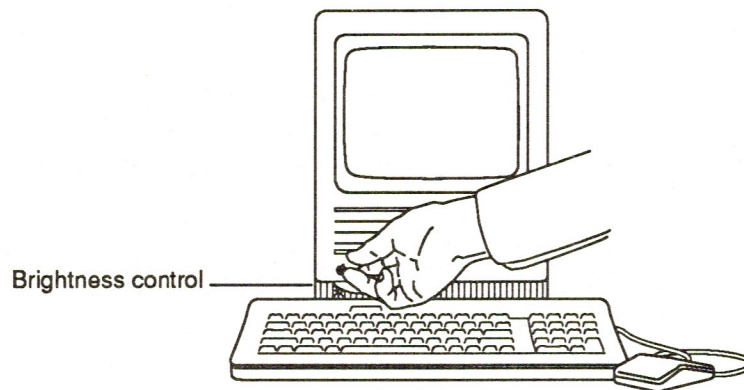
If you see the display called the “Sad Mac,” as shown in Figure 12, you may have a hardware problem. Check your connections and turn on the power again.



**Figure 12. Sad Mac display indicates a problem**

***Brightness Control***

If you heard the startup beep but do not see any display, you might need to adjust the brightness control, as shown in Figure 13.



**Figure 13. Adjusting the brightness control**

When you see a display like the one shown in Figure 10 or 11, your setup is correct.

7. Turn off the computer power switch.

**Continue with the next section, Setting Up Modular Macintosh Computers.**

---

# Setting Up Modular Macintosh Computers

## Overview

In the previous section of this module, you learned how to set up compact Macintosh computers. The significant difference between setting up the compact Macintosh computers and setting up the modular Macintosh computers is that with modular computers, you have to connect a separate monitor and may have to install a video card in the computer.

This section describes the general steps for setting up a modular Macintosh computer. The procedure is basically the same regardless of the computer model and the type of monitor. The only difference is that the Macintosh IIcx, Macintosh IIsx, and Macintosh LC have on-board video; you do not have to install a video card unless you plan to use a nonsupported monitor such as the Apple Two-Page monitor.

## General Steps

When you set up any modular Macintosh computer, you will perform the general tasks described below. **Do not perform these tasks now** (the steps are listed only as an overview). In the next section you will be given detailed directions for performing each task.

1. Carefully unpack the computer equipment. Save the packing materials.
2. Plug one end of the power cord into the power input on the computer and the other end into a three-hole grounded outlet.
3. If the system needs any expansion cards—such as a video card, communications card, coprocessor card, or memory expansion card—install them in the computer.
4. Connect the video cable to the monitor and to the video card installed in the computer.
5. Connect the monitor power cord to the monitor and the computer.
6. Connect the mouse to the keyboard.
7. Connect the keyboard to the computer.
8. Turn on the system to verify that everything is properly connected.

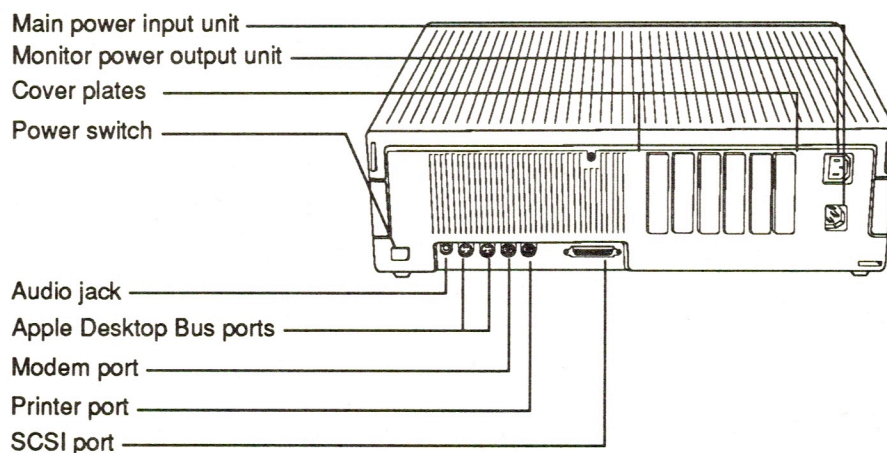
## External Ports

You can usually tell which port to use by looking at the icon above each port.

The following icons are the same for the Macintosh II, Macintosh IIfx, and Macintosh IIfx.

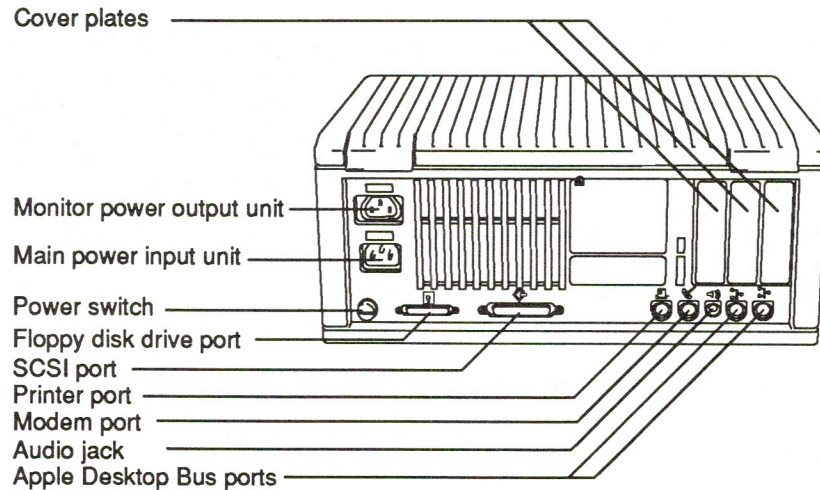
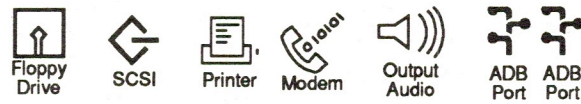


Figure 14 shows the ports and connector locations for the Macintosh II, Macintosh IIfx, and the Macintosh IIfx. They are identical on all three systems.



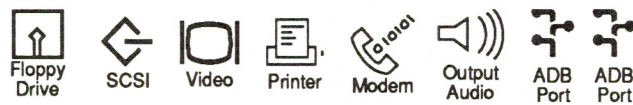
**Figure 14. Ports on the Macintosh II, Macintosh IIfx, and Macintosh IIfx**

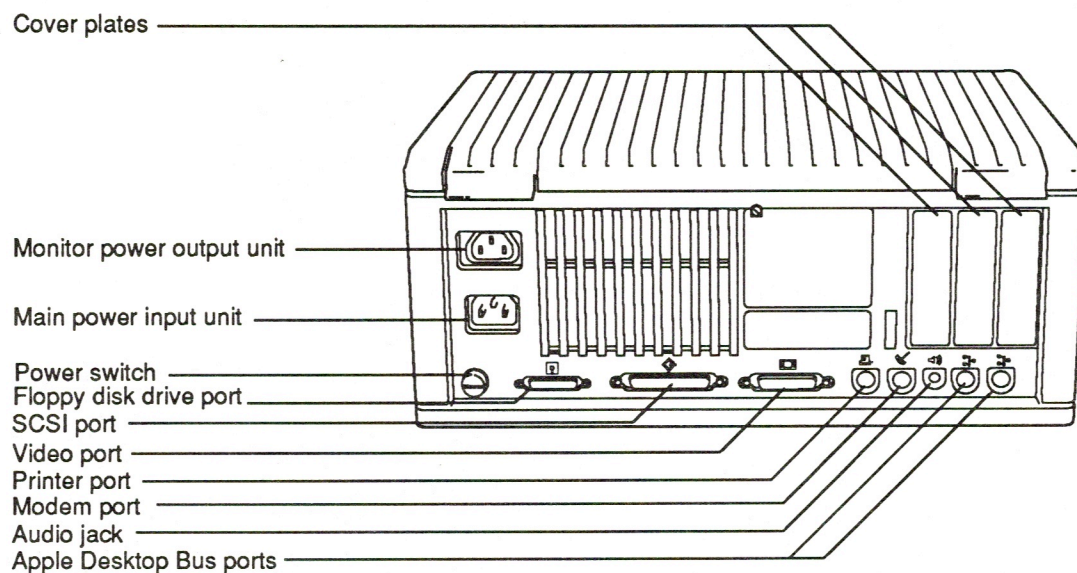
The icons for the Macintosh IIcx are shown below, followed by Figure 15 showing the port locations.



**Figure 15. Ports on the Macintosh IIcx**

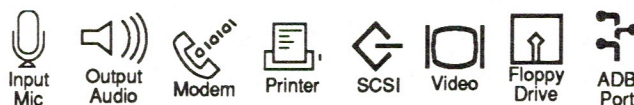
The Macintosh IIfx is almost the same as the Macintosh IIcx, except for the video port. The icons are shown below, followed by Figure 16 (on the next page) showing the port locations.





**Figure 16. Ports on the Macintosh IIci**

The changes in the Macintosh IIsi ports reflect the addition of an input sound jack and the elimination of one of the ADB ports. Below are the icons used on the back panel. Figure 17 on the next page shows the port locations.



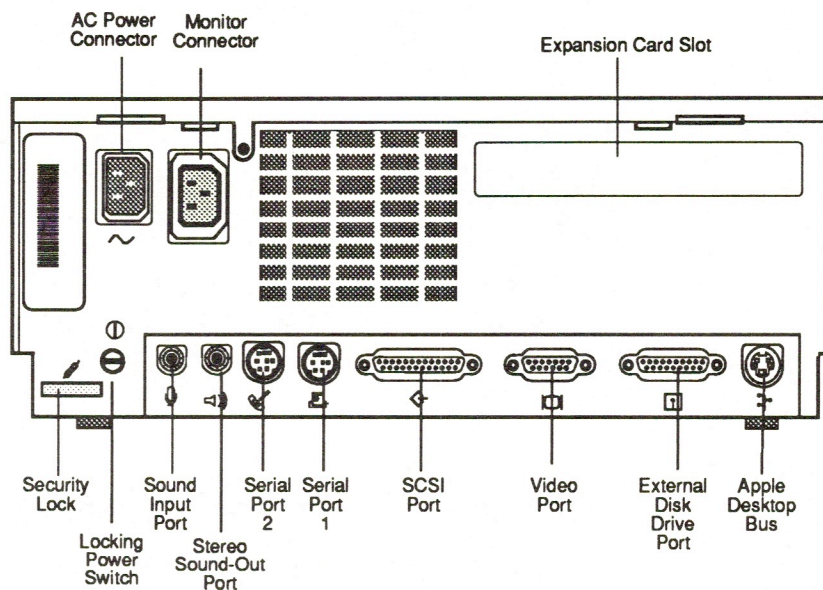


Figure 17. Ports on the Macintosh IIx

The Macintosh LC also has the sound input jack and one ADB port, but it does not have a floppy disk drive port. The icons for the Macintosh LC are shown next, and the port locations are shown in Figure 18.

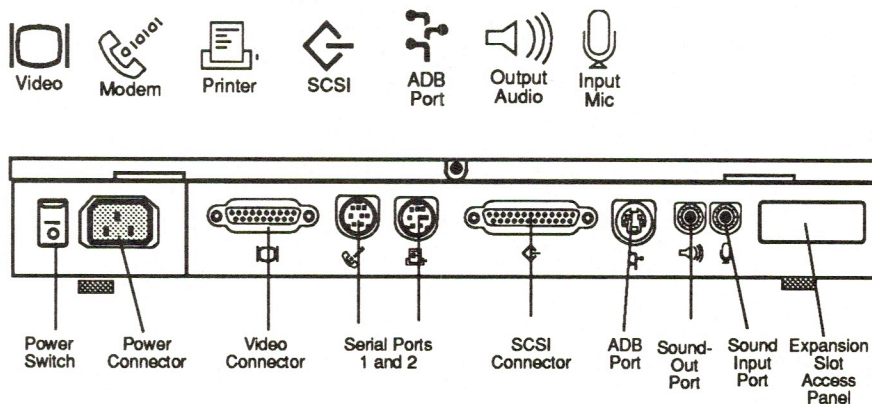


Figure 18. Ports on the Macintosh LC

Continue with the next section, **Exercise: Setting Up the Macintosh IIcx.**

---

# Exercise: Setting Up the Macintosh IICx

## Introduction

In this exercise, you will set up a Macintosh IICx. The procedures for setting up the various models of modular Macintosh computers are similar, so after this exercise, you should be able to set up the other modular models.

As with the Macintosh SE set-up exercise, this exercise will not explain how to configure the internal hard disk. You will learn that procedure in a later module of this course.

## What You Will Need

You will need the following materials for this exercise:

- Macintosh IICx with any drive configuration
- Monitor – either an Apple High-Resolution Monochrome monitor or an AppleColor High-Resolution RGB monitor
- Macintosh II video card – If you use a monitor other than the two listed above, check the monitor owner's manual to make certain that you have the appropriate video card.
- ADB mouse
- ADB keyboard
- Macintosh IICx power cord
- Macintosh II monitor video cable
- ADB keyboard cable

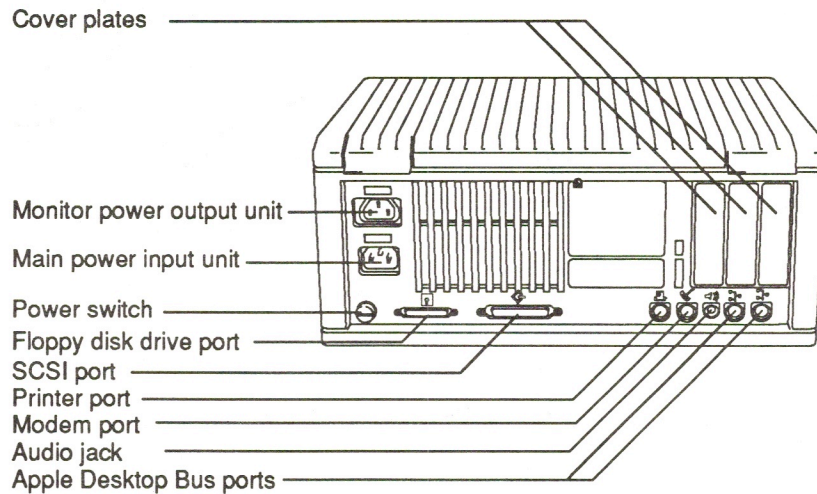
## Unpacking

If you haven't already done so, unpack the computer and the other materials provided in the packing box. Remember to save the packing materials.

## External Ports

Almost everything that you connect to the Macintosh IICx attaches to ports on the back panel of the computer, as shown in Figure 19. You can usually tell which port to use by looking at the icon above each port.

Locate these ports on your Macintosh IICx.



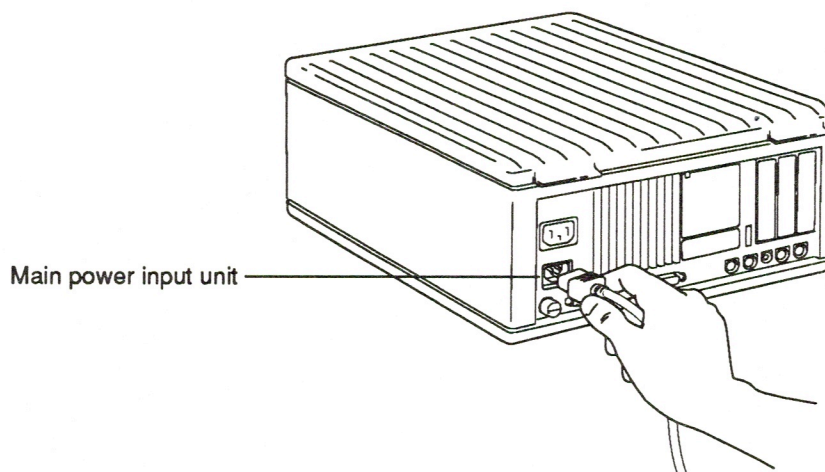
**Figure 19. Ports on the back panel of the Macintosh IICx**

## Setting Up the Computer

Now set up your system by following the steps on the next page.

### Connecting the Power Cord

1. Plug the power cord into the main power input unit, which is below the power switch on the back of the Macintosh IICx, as shown in Figure 20.



**Figure 20. Plugging in the power cord**

2. Plug the other end of the power cord into a three-hole grounded outlet.

The three-wire grounding plug is a safety feature. Do not modify it or use an adaptor.

As you continue to set up the Macintosh IICx system, leave the power cord plugged in, but be sure the power switch is turned off. When properly connected to a grounded outlet, the power cord serves to ground the computer electrically, even when the computer is turned off.

### Installing the Video Card

Before you can connect a monitor to the Macintosh IICx, you need to install a video card in the computer. Steps 3 through 6 provide directions for installing the video card.

Start with the front of the computer facing you.

3. Make sure you are using ESD safe equipment.

4. Remove the lid from the computer.
  - a. Using a Phillips screwdriver, loosen and remove the security screw that holds the lid to the computer. (It is at the top center of the rear panel, as shown in Figure 21.)
  - b. Wrap your hands around the rear corners of the case.

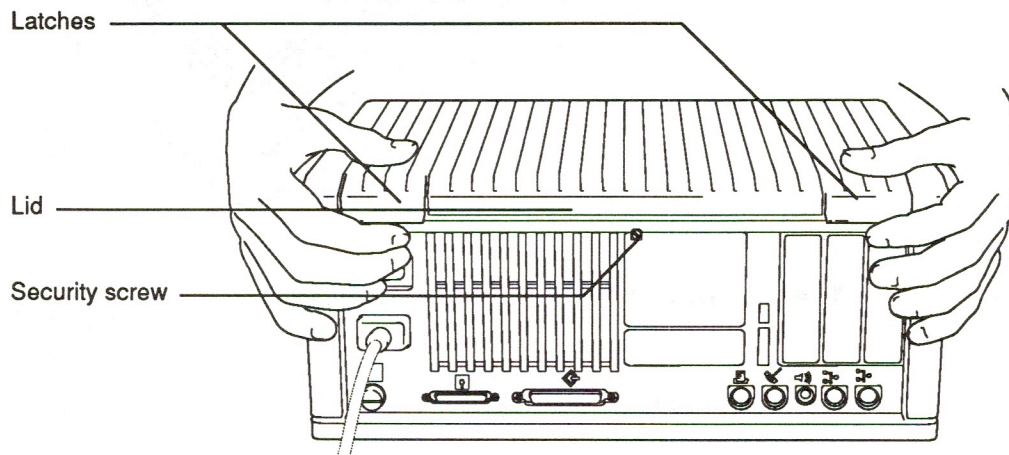
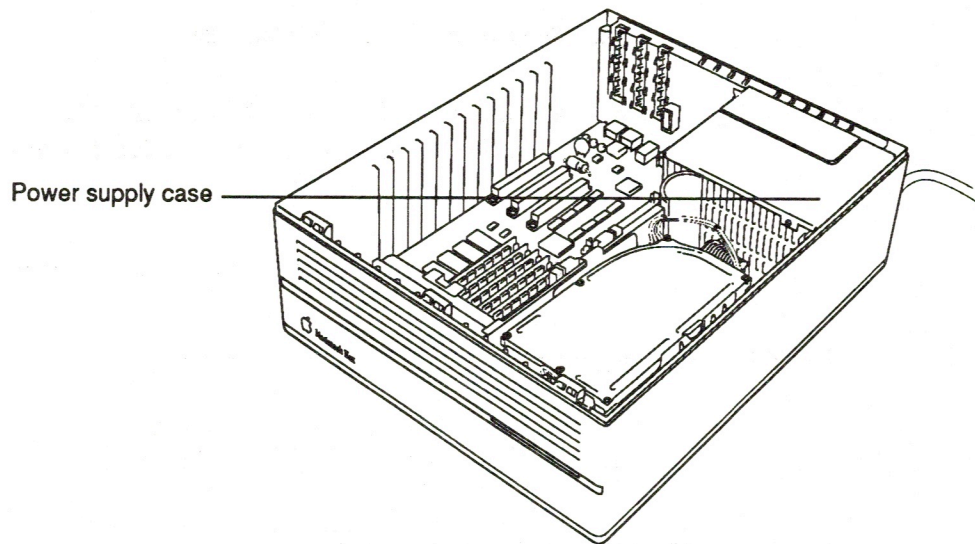


Figure 21, Removing the lid from the Macintosh IICX

- c. Pull up on the latches as you lift up on the back of the lid.
- d. Gently move the lid toward you and away from the main unit case.
- e. Lift the lid all the way off the case and put it aside.

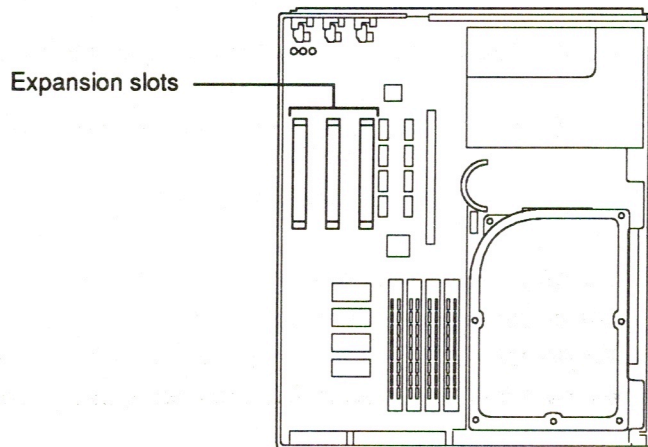
**Warning:** If you have just unpacked the computer, it is OK to touch the power supply. (See Figure 22 for location of the power supply.) However, the power supply can get hot during normal use. If the computer has been on, shut it off and wait at least five minutes before installing a video card.



**Figure 22. Power supply in the Macintosh IICX**

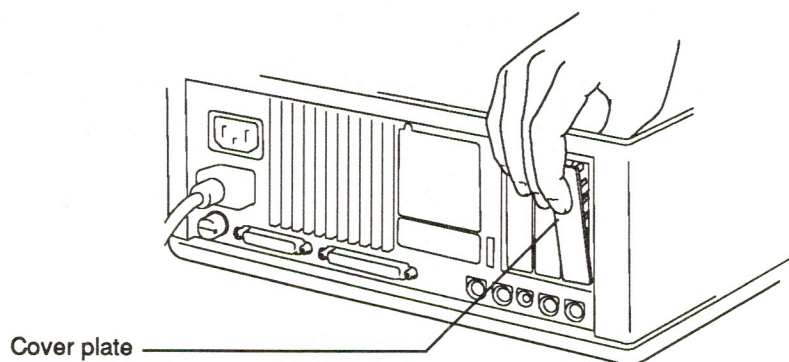
5. Choose the expansion slot you want to use.

The expansion slots are the three narrow, plastic connectors near the back-left corner, as shown in Figure 23. It does not matter which slot you choose.



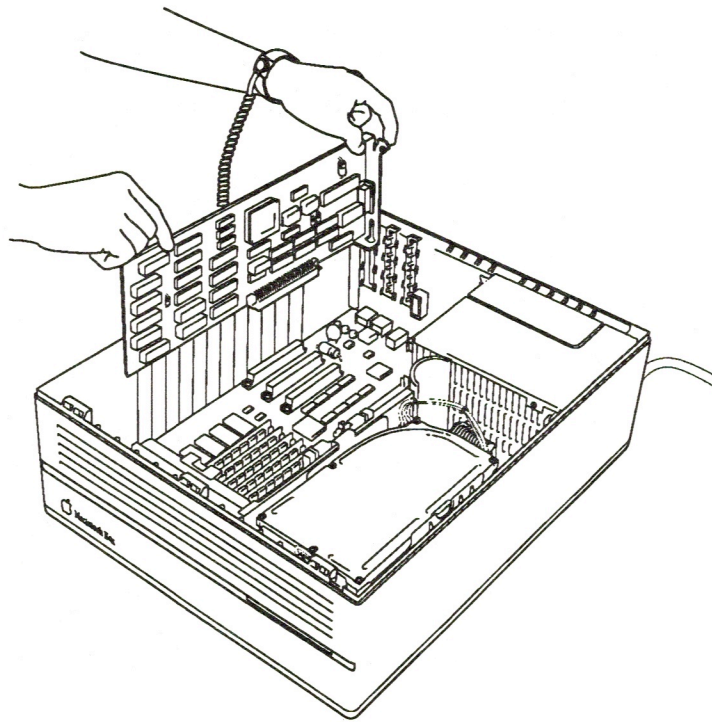
**Figure 23. Expansion slots in the Macintosh IICX**

6. Push out the cover plate in the back panel that lines up with the slot.
  - a. Grasp the plate with your thumb inside the computer and your fingers outside.
  - b. Push the plate out with your thumb, as shown in Figure 24, and set the cover aside. (Keep it for future use.)



**Figure 24, Removing the cover plate**

7. Insert the video card into the expansion slot.
  - a. Pick up the video card by the top of the metal bracket and the top of the card's other end. (Be careful not to touch the pins on the bottom edge of the card. See Figure 25 for proper handling.)



**Figure 25. Proper way to handle the video card**

- b. Align the card over the slot you have chosen. Make sure that the connector on the bottom of the card aligns directly over the slot, and that the rear edge aligns with the tab on the inside of the back panel. See Figure 25.
- c. Place one hand along the top edge of the card; push down firmly on the card until the connector is fully seated.

**Important:** *Do not force the card. If you feel a lot of resistance, pull the card out and try again.*

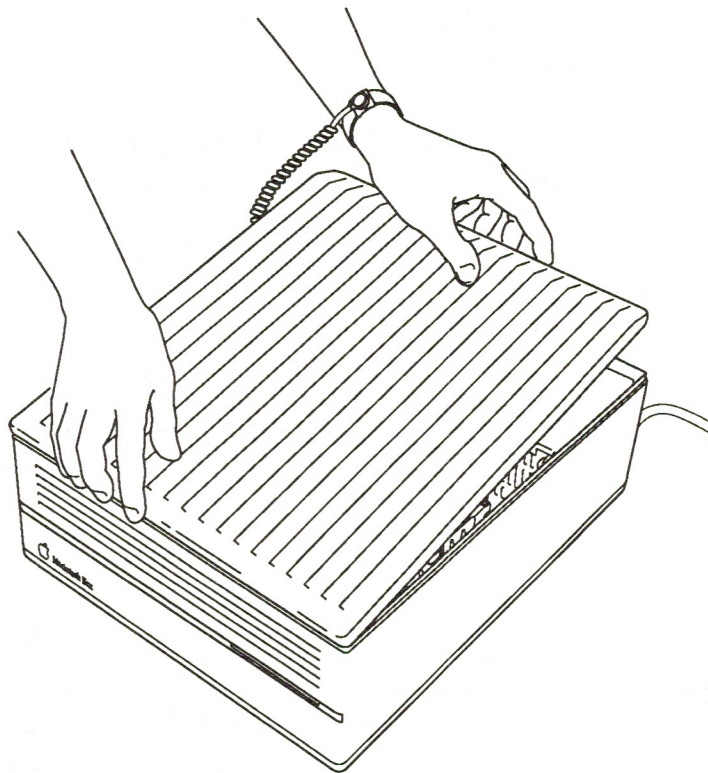
Do not wiggle the card from side to side when you insert it; this puts unnecessary stress on the card and slot.

You can test to see if the card is properly connected by lifting the card gently. If it resists and stays in place, it is connected. After testing, reseal the card.

### Installing Other Cards

In this exercise, you are installing only the video card. If you were to set up a system that includes other cards, you would install them at this time by following the same procedure (steps 3 through 7).

8. Replace the lid on the computer.
  - a. Tip the front of the lid down onto the front edge of the computer case, as shown in Figure 26.



**Figure 26. Replacing the Macintosh IICx lid**

- b. Lower the back of the lid onto the case and press firmly on the back corners until you hear the rear latches snap into place.
    - c. Replace and tighten the security screw on the back panel.

### Connecting the Video Cable

9. Turn the computer so the back panel faces you. Place the monitor near the computer and turn the monitor so the back panel also faces you.
10. Plug one end of the video cable into the video socket on the back of the monitor.

**IMPORTANT:** On most video cables for Macintosh monitors, both ends are the same—it does not matter which end you attach to the video socket. However, some monitor cables have different connectors at the ends. Be sure you compare the connectors and attach the correctly sized connector to the monitor.

11. Tighten the thumbscrews on the connector. A tight connection keeps the cable from coming loose and prevents radio and television interference.
12. Plug the other end of the video cable into the socket on the video card and tighten the thumbscrews. Connect the cable to the card through the opening in the computer's back panel as shown in Figure 27.

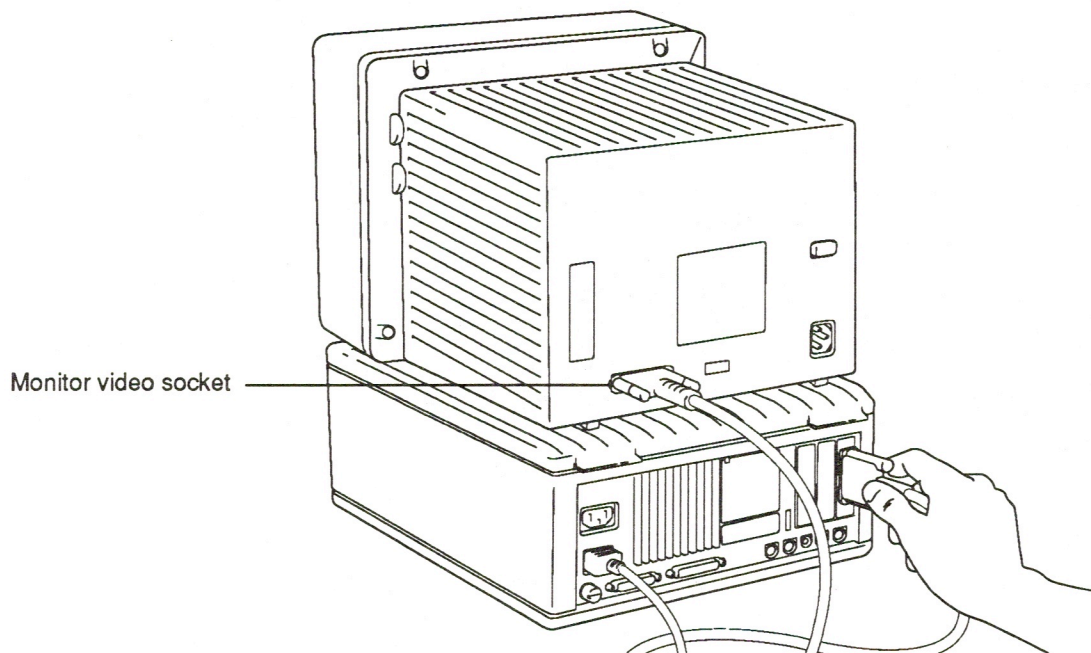
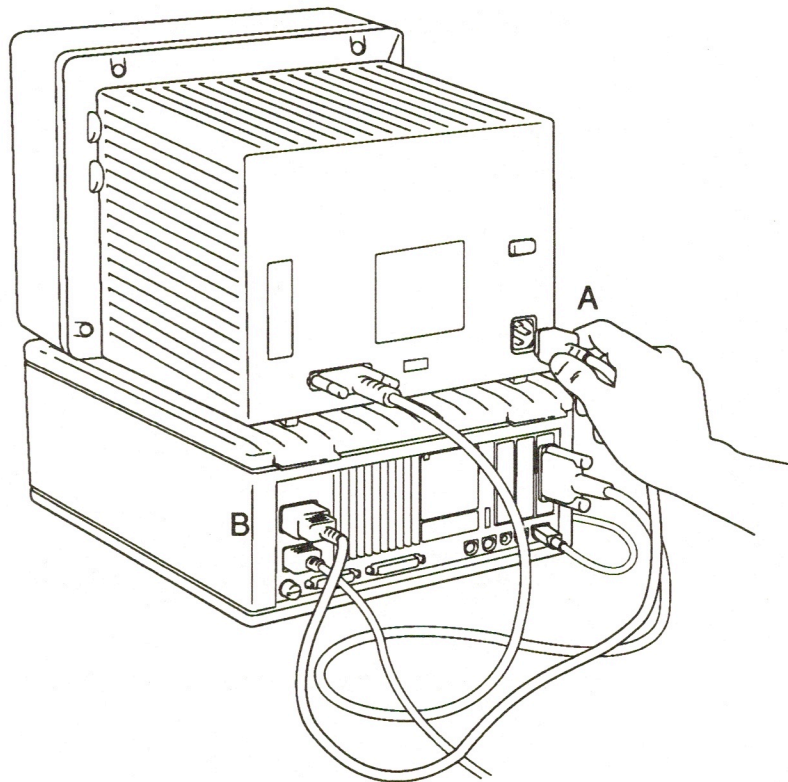


Figure 27. Connecting the video cable

**Connecting the Monitor's Power Cord**

13. Plug the socket end of the power cord into the monitor power input unit on the back of the monitor, as shown in Figure 28a.
14. Connect the other end of the power cord to the monitor power output unit on the back of the computer, as shown in Figure 28b.



**Figure 28. Connecting the monitor's power cord**

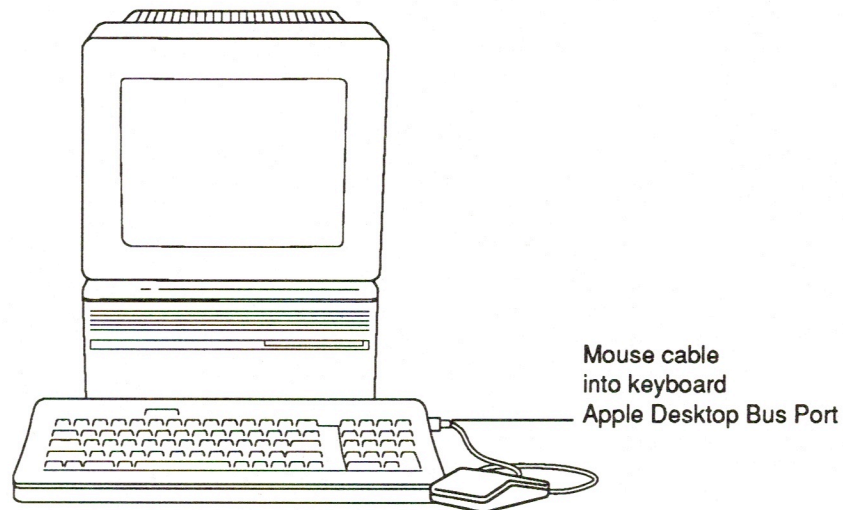
**Connecting the Mouse and Keyboard**

As with the compact Macintosh computers, there are several ways to connect the mouse and the keyboard to a modular Macintosh. One way is by daisy-chaining the mouse to the computer. (The mouse will be connected to the computer through the keyboard.)

**Important:** These steps are presented so that the last thing you do is connect the keyboard. (Accidentally pressing the Power On key would turn the computer on prematurely.)

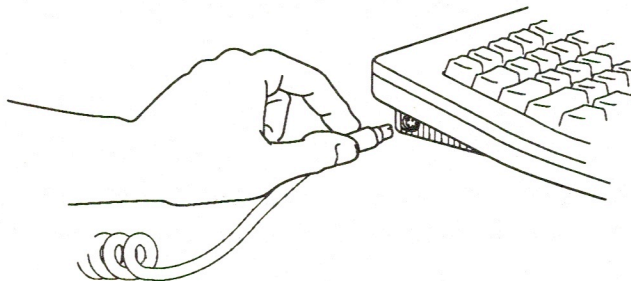
Although the ADB keyboards may look different, you attach them all to the computer in the same way.

15. With the keyboard facing you, plug the mouse cable into the port on the right side of the keyboard, as shown in Figure 29.



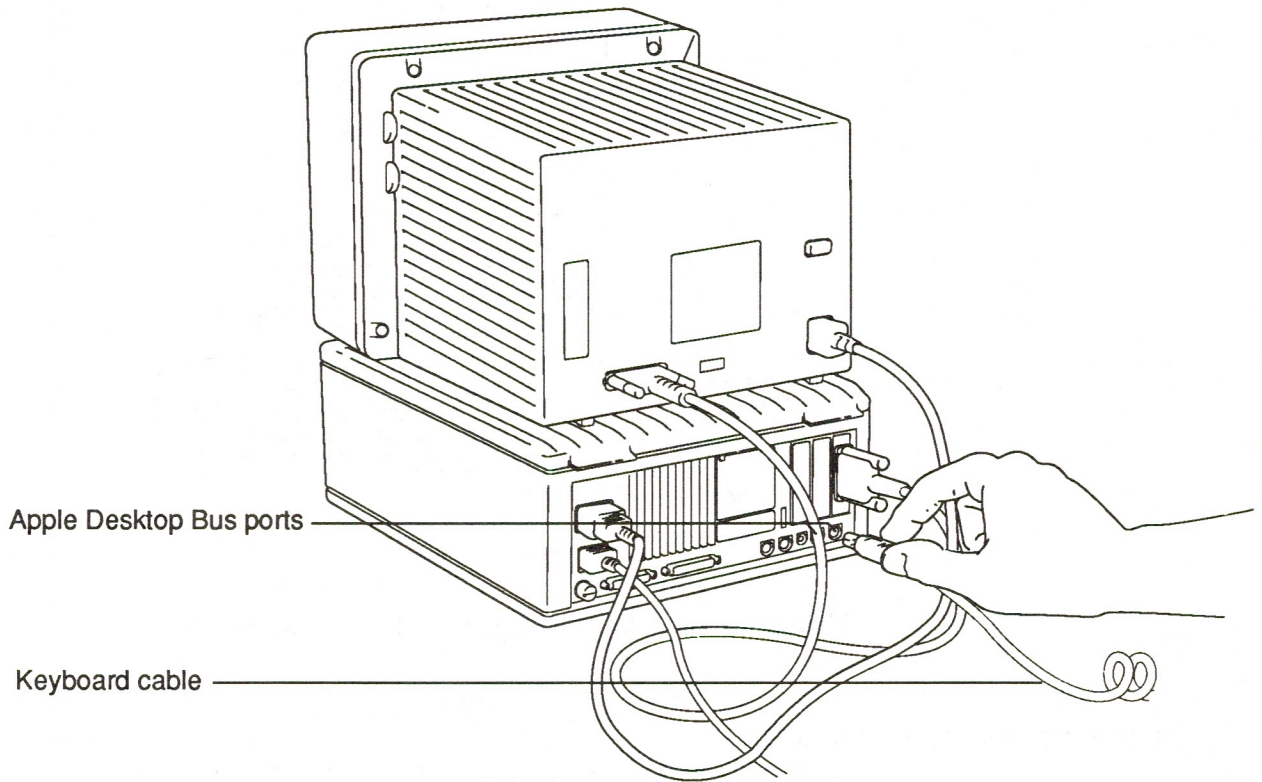
**Figure 29. Connecting the mouse to the right side of the keyboard**

16. Plug one end of the keyboard cable into the left port on the keyboard, as shown in Figure 30.



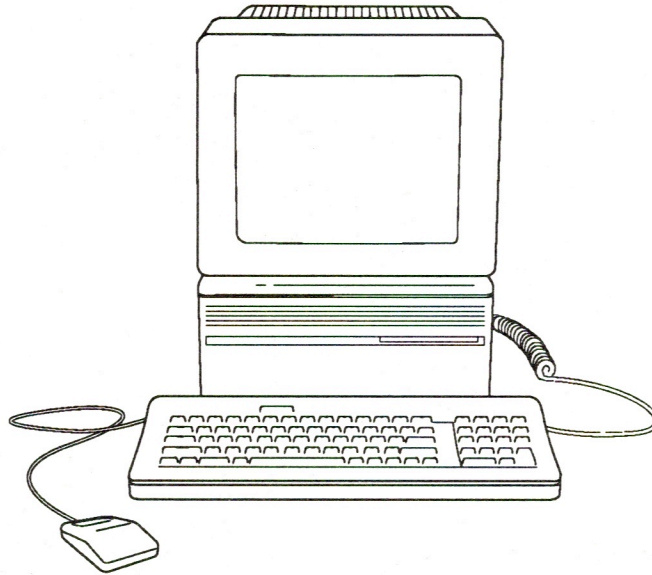
**Figure 30. Connecting the keyboard cable to the keyboard**

17. Plug the free end of the keyboard cable into either of the two ADB ports on the back of the computer, as shown in Figure 31.



**Figure 31. Connecting the keyboard cable to the computer**

Figure 32 illustrates how you can reverse the mouse and keyboard cables to accommodate left-handed users.



**Figure 32. Alternative configuration for left-handed users**

### Connecting Other ADB Devices

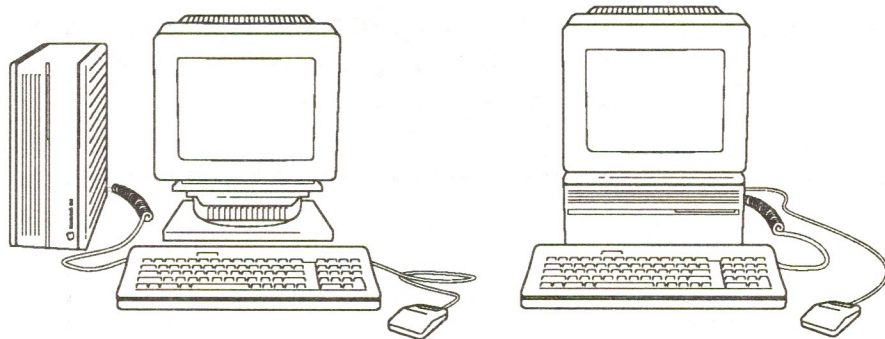
Another alternative is to connect the mouse to the other ADB port on the back of the computer.

Remember that the keyboard and mouse are just two of the ADB devices that can be connected to these ports. You can add other ADB devices, such as a graphics tablet, a joystick, or another keyboard, to the system by connecting them to the keyboard or to one of the two ADB connectors on the back panel of the Macintosh IICX.

**Caution:** *Always turn off the system power before you connect or disconnect ADB devices.*

### Configuring the Macintosh System Components

The Macintosh IICx and Macintosh IICI are designed to adapt to a variety of physical configurations to meet the individual preferences. For example, you can place the monitor on top of the computer, or you can also place the computer off to the side or on a shelf. You can save space by turning the computer on its side. Figure 33 shows two alternatives.



**Figure 33. Some common Macintosh IICx physical configurations**

If you turn the computer on its side, you will need to remove the small rubber feet from the bottom of the computer and remount them on the computer's left side to keep it stable and properly ventilated.

***Note:** The Macintosh IICx and Macintosh IICI are the only Macintosh computers to offer this flexibility. The Macintosh II, IIfx, IIfx, IISI, and LC computers must be kept flat. Standing them on edge defeats their cooling design and is likely to make the computer overheat.*

### Turning On the System

You can verify that a modular system is properly connected exactly as you verified the connections on the compact Macintosh computers.

18. Turn on the system power by pressing the keyboard's Power On key shown in Figure 36. A chime indicates that the computer has started.

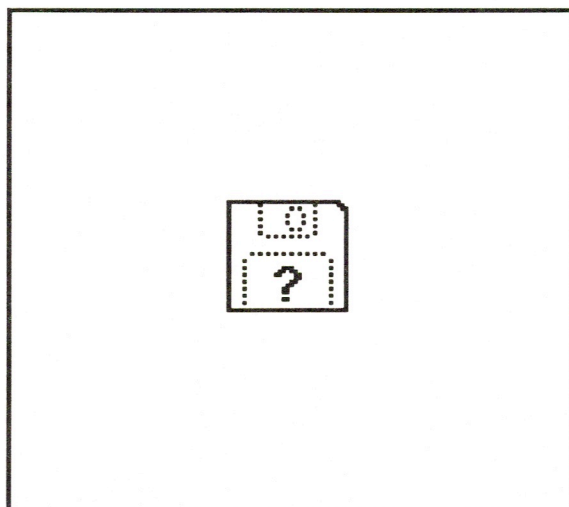


**Figure 36. Power On on the Apple ADB Keyboards**

If the system does not start up, turn off the system power. Make sure that all of the connections are secure and that your power source is good. Then try to power on the system again. Listen for the chime.

19. Turn on the monitor.

An icon representing a Macintosh disk should appear on the screen, as shown in Figure 34. The blinking question mark shows that the Macintosh IICx is ready for you to insert a disk.



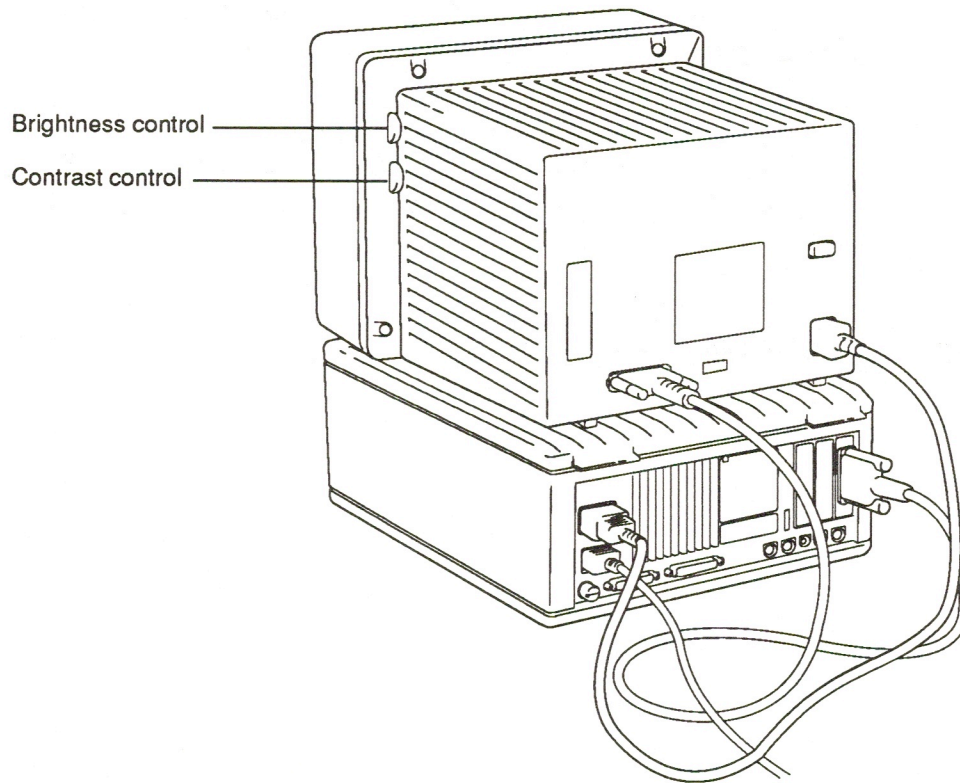
**Figure 34. Startup screen when no disk is in the system**

As with the Macintosh SE, if your screen does not look like the one shown in Figure 34, the hard disk may already have been configured. For now, turn off the Macintosh IICx, and continue with the next section.

If you see the Sad Mac display, you may have a hardware problem. Get another Macintosh IICx for this exercise.

**Brightness Control**

20. If you heard the startup chime but do not see anything on the screen, you might need to adjust the brightness or contrast controls, shown in Figure 35.



**Figure 35. The brightness and contrast controls**

If your screen shows the diskette with the blinking question mark, your setup is correct.

21. Turn off the computer power switch.

### **Turning Off and On the Macintosh IICX**

The power switch on the computer's back panel is not intended for regular use. Normally, you turn the computer on with the Power On key on the keyboard.

You turn the computer off by choosing the Shut Down command from the Special menu. (You will learn about this command in the module entitled Using Macintosh Computers.)

If you have a problem with the computer and cannot use the Shut Down command to turn it off, push the power switch on the rear of the computer instead. Then you can start it again by pressing the Power On key.

**Continue with the next section, Module Summary.**

---

# Module Summary

## Setting Up Compact Macintosh Computers

The procedures for setting up a Macintosh Plus, SE, SE/30, and Classic are basically similar. Because the Macintosh Plus does not have the ADB, the steps for connecting the mouse and keyboard differ slightly.

In general, these are the steps you perform when setting up a compact Macintosh computer:

1. Unpack the equipment.
2. Connect the power cord to the computer and to a three-hole grounded outlet.
3. Connect the keyboard to the computer.
4. Connect the mouse to the keyboard or the computer.
5. Turn on the system to verify that it works.

## Setting Up Modular Macintosh Computers









Setting up a modular Macintosh computer differs from setting up a compact in that you have to connect a separate monitor to the computer. For the Macintosh II, IIfx, IIfx, and IIfx, a video card must be installed. For the Macintosh IIfx, IIfx, and LC, a video card is optional, as these units have built-in video capabilities. The procedures for setting up a modular Macintosh computer are similar for all six models.

In general, these are the steps for setting up a modular Macintosh computer:

1. Unpack the equipment.
2. Connect the power cord to the computer and to a three-hole grounded outlet.
3. Install the video card, if necessary.
4. Connect the video cable to the monitor and to the video card or video port.
5. Connect the monitor power cord to the monitor and the computer, except for the Macintosh LC. The power cord has to be connected separately for the LC.
6. Connect the mouse to the keyboard.
7. Connect the keyboard to the computer.
8. Turn on the system to verify that it works.

### External Ports

The chart below summarizes the external ports on all the Macintosh systems.

Macintosh Model	Ports Available	 Floppy Drive	 Output Sound	 SCSI Drive	 Modem Port	 Printer Port	 ADB Port	 Video Port	 Input Sound
Macintosh Plus		⌘	⌘	⌘	⌘	⌘			
Macintosh SE		⌘	⌘	⌘	⌘	⌘	⌘		
Macintosh SE/30		⌘	⌘	⌘	⌘	⌘	⌘		
Macintosh Classic		⌘	⌘	⌘	⌘	⌘	⌘ <sup>1</sup>		
Macintosh II			⌘	⌘	⌘	⌘	⌘		
Macintosh IIx			⌘	⌘	⌘	⌘	⌘		
Macintosh IIfx			⌘	⌘	⌘	⌘	⌘		
Macintosh IICx		⌘	⌘	⌘	⌘	⌘	⌘		
Macintosh ILCi		⌘	⌘	⌘	⌘	⌘	⌘	⌘	
Macintosh IISI		⌘	⌘	⌘	⌘	⌘	⌘ <sup>1</sup>	⌘	⌘
Macintosh LC			⌘	⌘	⌘	⌘	⌘ <sup>1</sup>	⌘	⌘

1 = Only One ADB Port

***Alternative Keyboard Configurations***

With computers that have the ADB, you can connect the mouse to the computer in several different ways:

1. Connect the mouse to the ADB port on the right side of the keyboard. Connect the keyboard cable to the left side of the keyboard and to the ADB port on the computer.
2. Connect the mouse to the ADB port on the left side of the keyboard. Connect the keyboard cable to the right side of the keyboard and to the ADB port on the computer. This configuration is for left-handed users.
3. Connect the mouse directly to the ADB port on the computer. This method cannot be done on the Macintosh Classic, Macintosh IIsx, and Macintosh LC as there is only one ADB port on each of these systems. Use one of the methods described in step One or Two above.

**You have now completed this module.**

**Check your skills and knowledge against the Skills Checklist for this module. When you are ready, take the Module Test.**

# Module Test

## Directions

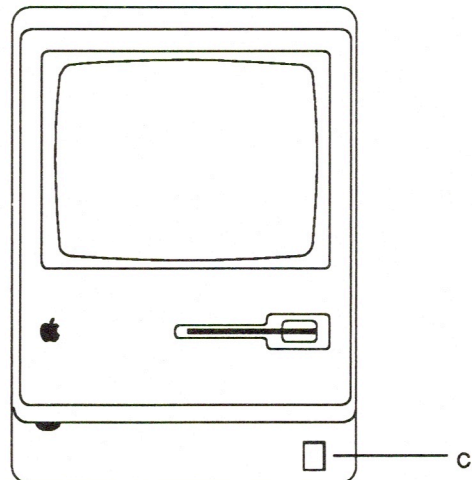
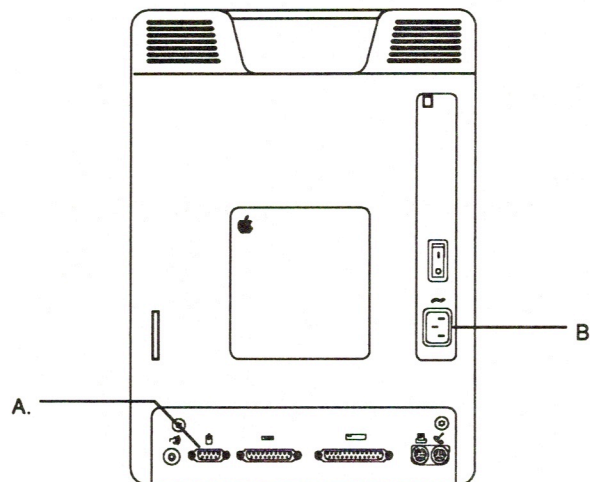
This test consists of different types of questions. Answer each item as indicated.

1. Here is a list of external ports on the Macintosh Plus. Below the list are two figures of the Macintosh Plus with arrows pointing to the various connectors and parts. For each connector/part, write the letter that indicates its location as shown in the figures.

A mouse port

C keyboard port

B power input unit



2. After the equipment is unpacked, what four general tasks are involved in setting up the basic compact Macintosh computer?

a. Plug Power

b. Plug Keyboard

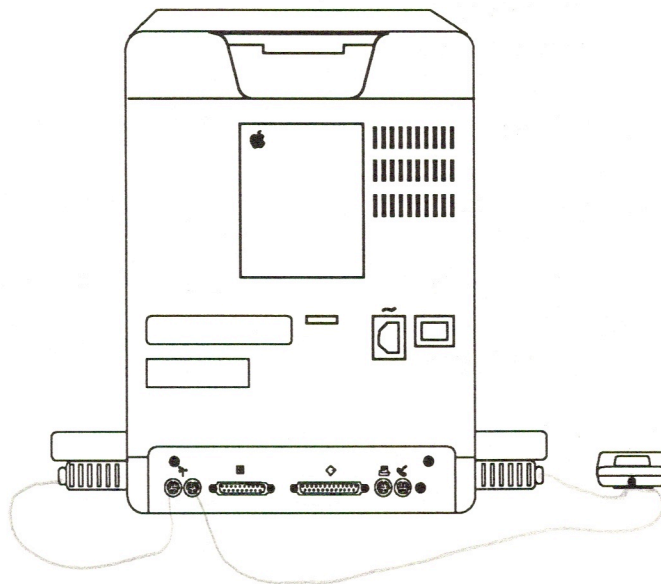
c. " Mouse

d. Push on

3. Why should you leave the power cord plugged in while you are setting up a Macintosh system?

for ground

4. Draw lines on the following figure to indicate the best way to connect the mouse and keyboard to a Macintosh SE, SE/30, or Classic for a left-handed user.

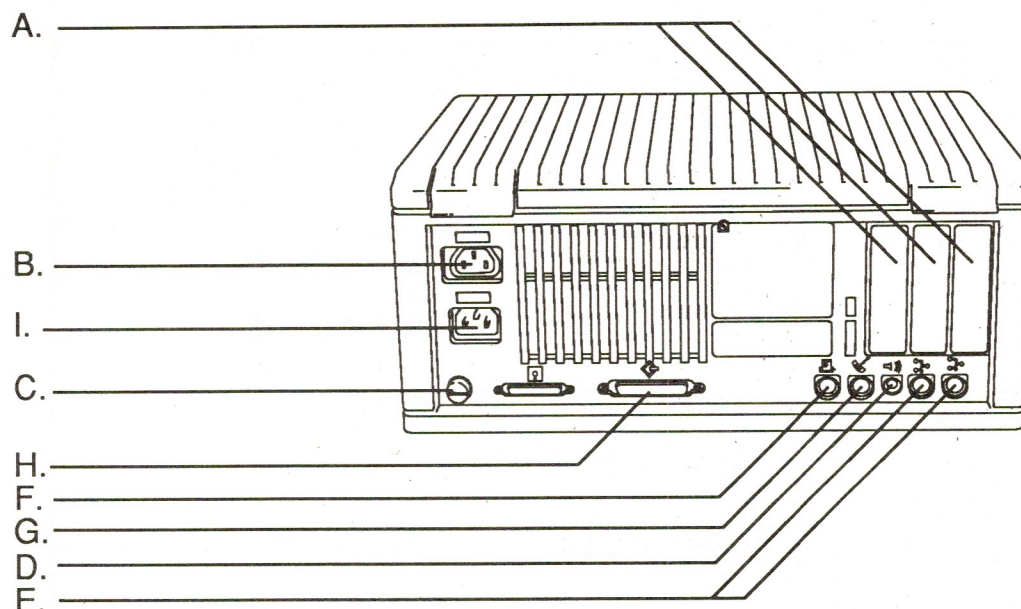


5. After the equipment is unpacked, what seven general tasks are involved in setting up the basic modular Macintosh computer?

- a. Power cord
- b. Video Cd
- c. Keyboard
- d. Mouse
- e. Monitor Power
- f. " Cd
- g. Power on

6. Here is a list of Macintosh IIcx external connectors and parts. On the next page is a figure of the Macintosh IIcx with arrows pointing to the various connectors and parts. For each connector/part, write the letter that indicates its location as shown in the figure.

- |                                    |                       |
|------------------------------------|-----------------------|
| <u>H</u> SCSI port                 | <u>D</u> Audio jack   |
| <u>E</u> ADB ports                 | <u>F</u> Printer port |
| <u>I</u> Power input unit          | <u>C</u> Power switch |
| <u>G</u> Modem port                | <u>A</u> Cover plates |
| <u>B</u> Monitor power output unit |                       |



7. If a Macintosh IIcx has been on, which component should you avoid touching when you open the computer? Why should you not touch it?

Power Supply

8. TRUE or FALSE: Always turn off the Macintosh system power before you connect or disconnect ADB devices.

TRUE ☒

FALSE ☐

9. TRUE or FALSE: You should replace the yellow plastic disks in the disk drives whenever the Macintosh computer is not in use.

TRUE ☐

FALSE ☒

10. After powering on a compact Macintosh, what is the first indication that the system is properly set up?

Beep

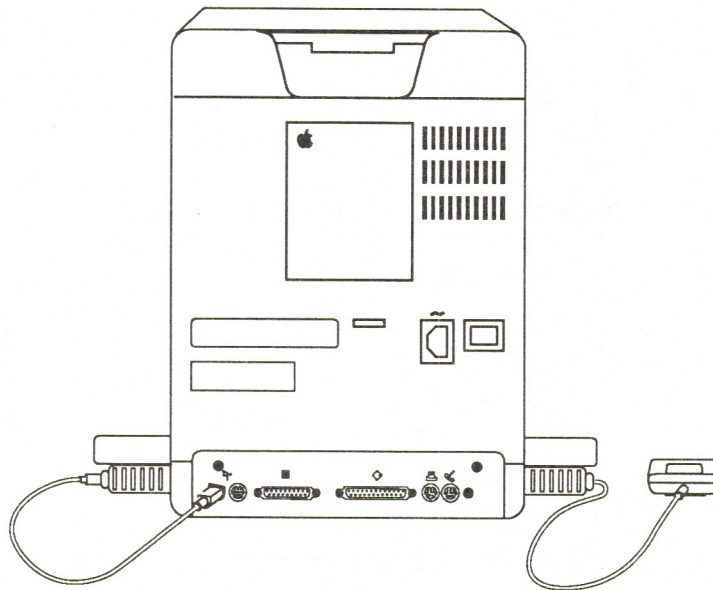
11. When you turn on a Macintosh to verify that it is properly connected, you might see a blinking question mark. What is the computer telling you? Check the correct answer.

- ☐ a. The monitor is not connected correctly.
- ☒ b. The Macintosh is ready for you to insert a disk.
- ☐ c. The internal hard disk has already been configured.
- ☐ d. The mouse input is not connected correctly.
- ☐ e. The keyboard input is not connected correctly.

**Compare your answers to those provided on the following pages.**

## Module Test (Answers)

1. A. mouse port  
B. power input unit  
C. keyboard port
2. a. Connect the power cord.  
b. Connect the keyboard.  
c. Connect the mouse.  
d. Turn on the system to verify it works.
3. You should leave the power cord plugged in while you set up the Macintosh because the power cord serves as a grounding device; but be sure that the power switch is turned off.
- 4.



5. a. Connect the power cord.  
b. Install the video card, if necessary.  
c. Connect the video cable to the monitor and video card.  
d. Connect the monitor power cord to the monitor and computer.  
e. Connect the mouse.  
f. Connect the keyboard.  
g. Turn on the system to verify it works.

6. H SCSI port                      D Audio jack  
E ADB ports                      F Printer port  
I Power input unit              C Power switch  
G Modem port                      A Expansion slot covers  
B Monitor power output unit

7. The power supply, because it can get hot during normal use.

8. TRUE

9. FALSE

10. You should hear a beep.

11. b

**REMINDER:** *This written test does not verify that you can perform the hands-on tasks covered in this module. Be sure you can perform all of the tasks listed on the Skills Checklist before attending the Prerequisite Exam and the lab part of this course.*

**Before continuing with the next module, refer to the evaluation booklet and complete the evaluation for this module.**

# Using Macintosh Computers

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# Module Introduction

## Overview

All Macintosh computers have the same user interface, which means that if you can use one Macintosh computer, you will be able to use all Macintosh computers. The more skill you acquire in using Macintosh computers, the more efficiently you will be able to service them.

This module will introduce you to the basics of using Macintosh computers and to the common startup tasks that you may need to perform for your customers.

Although the skills and information you learn in this module apply to all Macintosh computers, minor differences exist. To avoid complications that could be caused by such minor differences, the module exercises direct you to use a Macintosh SE.

## What You Will Learn

By the end of this module, you should be able to:

- Use basic Macintosh commands
- Use a typical Macintosh application
- Identify the basic components of the Macintosh system software
- Create a startup disk
- Perform basic tasks involved in customizing a startup disk to users' needs

The Skills Checklist following this Module Introduction lists, in detail, the tasks you should be able to perform upon completion of this module.

**Note:** *System 7.0 training is now an optional portion of the Macintosh Service Course Lab.*

## How You Will Be Tested

**The Module Test**—This written test will help you verify that you have achieved the tasks outlined in the Skills Checklist.

**Prerequisite Exam**—Consisting of hands-on and written items, this test will verify that you have mastered the module skills and are ready for the Lab part of this course.

Throughout all of the tests, you will be able to refer to these instructional materials and to other Apple reference materials.

### Prerequisites to the Module

Before beginning this module, you must have satisfactorily completed these modules:

- Welcome to Apple Service
- Understanding ESD
- Macintosh Basic Features
- Setting Up Macintosh Computers

### Materials Needed for this Module

The Prerequisite provides the following items for this module:

- This Module Workbook
- *Macintosh Basics* disk
- Module Test

You need to provide the following:

- a Macintosh SE with mouse, keyboard, power cord, and keyboard cable—you can use a computer that has either two floppy disk drives or one floppy disk drive and an internal hard disk
- a current *Macintosh System Tools* disk
- a current *Macintosh Utilities* disk

If you have the *Macintosh SE Owner's Manual*, the *Macintosh Utilities User's Guide*, or other Macintosh user's manuals, you might want to refer to them throughout the hands-on activities in this module.

### How the Module Is Organized

This module is presented in two parts.

**Part 1—Basic Commands and Applications** - The Macintosh tour disk will introduce you to basic Macintosh usage through hands-on exercises. Then, you will increase your skill in using Macintosh applications by going through additional hands-on practice in this module.

**Part 2—Startup Tasks** - This part begins with an overview of how the Macintosh system software is organized. Then you will learn how to make backup disks, configure the internal hard disk, create startup disks, and configure the Chooser and the Control Panel.

These two parts are followed by a Module Summary.

---

# Skills Checklist

## What Is the Skills Checklist?

This is a list of tasks that you should be able to perform at the conclusion of this module. The Prerequisite Exam (written and hands-on) will cover these items. During the Lab part of this course, you will be expected to be able to perform all of these tasks.

## How to Use the Checklist

Before starting the module, check the items on this list to see which tasks you can already perform. If you are confident that you can already perform certain tasks, you may decide to skip those parts of the module. Or you may decide to try the module test without going through the module.

**After completing the module, check this list to make certain that you have mastered all of the skills before you attend the Prerequisite Exam and the Lab part of this course.** If you feel uncertain about any of these tasks, return to the section indicated, review the information, and repeat the hands-on exercises.

Task	Section Where the Task Is Covered
___ 1. Boot the system from a diskette.	Taking the Macintosh Tour
___ 2. Point, click, and drag with the mouse.	Taking the Macintosh Tour
___ 3. Use the Macintosh desktop: - identify information provided on the desktop - open icons - select menu items - identify icon types - close a window - make a window active - eliminate documents - nest files/folders in folders	Taking the Macintosh Tour
___ 4. Use a typical word-processing application: - create a document - save a document - cut and paste text - use the hierarchical file system to locate and open documents from within an application	Using a Macintosh Application
___ 5. Identify the functions performed by Macintosh software components.	Introduction to Macintosh Software
___ 6. Identify the meaning of basic software terms: - managers - resources - device drivers - cdev	Introduction to Macintosh Software
___ 7. Identify where the system software is stored.	Introduction to Macintosh Software
___ 8. Initialize 800K diskettes.	Making Copies of Disks
___ 9. Identify the formats that can be read by each type of Macintosh disk drive.	Making Copies of Disks

Task	Section Where the Task Is Covered
___ 10. Make backup copies of diskettes.	Making Copies of Disks
___ 11. Identify the contents of the System Folder and match the contents with their functions.	Exploring the System Folder
___ 12. Explain what the Finder is.	Exploring the System Folder
___ 13. Indicate how MultiFinder differs from Finder.	Exploring the System Folder
___ 14. Explain what a startup disk is.	Startup Disks
___ 15. Identify the files that must be placed on a startup disk.	Startup Disks
___ 16. Indicate the sequence in which the system searches for the startup disk.	Startup Disks
___ 17. Identify the current startup disk on a system.	Startup Disks
___ 18. Initialize the internal hard disk.	Preparing the Macintosh Internal Hard Disk
___ 19. Make the internal hard disk a startup disk.	Preparing the Macintosh Internal Hard Disk
___ 20. Create a 3.5-inch startup diskette by using the Installer.	Making Startup Diskettes
___ 21. Customize a startup disk by using the Font/DA Mover.	Making Startup Diskettes
___ 22. Update a startup disk.	Making Startup Diskettes
___ 23. Identify the minimum and maximum number of DAs a system can have under normal circumstances.	Making Startup Diskettes
___ 24. Set the various parameters (such as the system clock) on the Control Panel.	Configuring the Control Panel

**Continue with the next section - Taking the Macintosh Tour.**

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# Taking the Macintosh Tour

## Overview

Every Macintosh is shipped with a *Macintosh Basics* "Tour Disk." These tour disks provide hands-on practice in using the basic Macintosh commands and are an excellent way to start learning how to use a Macintosh.

This section will direct you to take the tour entitled *Macintosh Basics* which will teach you how to:

- use the mouse
- use basic commands
- use a typical Macintosh application
- manage documents

**Unless you already know how to use the Macintosh, you should take this tour. The rest of this module will assume that you have mastered the skills covered in the Tour.**

This section has two parts. The first provides directions for starting up your system and using the tour disk. The second part provides a summary of commands for using the desktop. After you have completed the tour, you may want to return to the summary of command pages to review basic terms and procedures.

**What You Will Need**

You will need to provide the following materials for this activity:

- a Macintosh SE, set up with a mouse and keyboard
- the *Macintosh Basics* disk

**Directions for Accessing the Tour**

Take the tour now by following these steps:

1. Insert the *Macintosh Basics* disk into the disk drive.
2. Turn on the system power. This starts up (boots) the system from the disk inserted in the disk drive.
3. When you get to the main menu, click on the first selection, "Getting Around in Macintosh Basics." Then step through each of the other main menu selections.
4. Follow the directions on the screen to learn how to use the "point, click, and drag" mouse techniques.
5. When you are confident that you can perform the tasks covered in the tour, exit by selecting Quit from the main menu. You can repeat parts of the tour as you feel is necessary.
6. Turn off the Macintosh when you have completed the tour.

## Summary of Using the Macintosh Desktop

This section is a summary of desktop basics you learned in the tour. For a review of the icons, menus, and other parts of the desktop, see Figures 1 through 3. For a review of basic desktop commands, see the descriptions following the figures.

**Note:** All screens in this module are based on System 6.0.5. If you are using System 7.0, your screen will look slightly different.

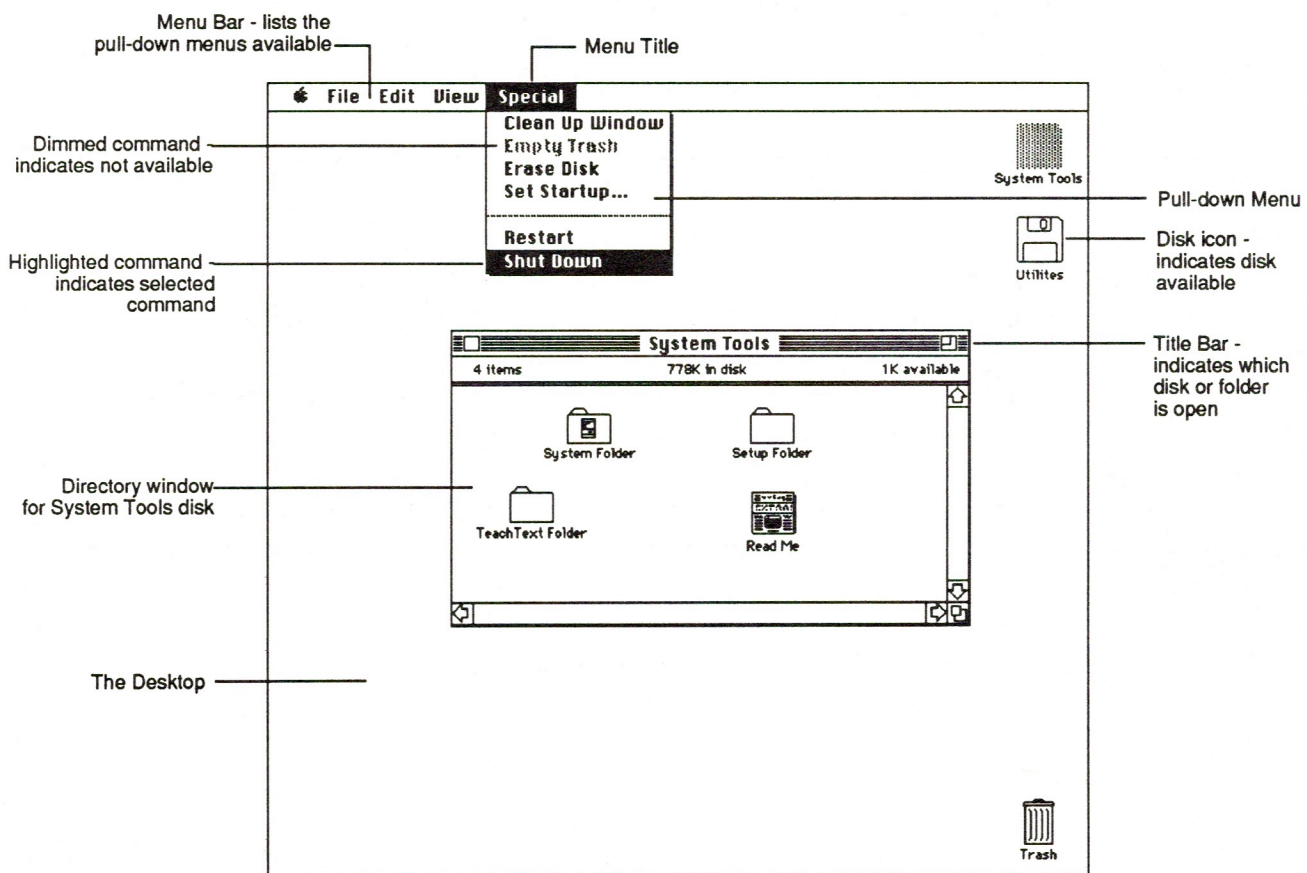


Figure 1. Desktop features and commands

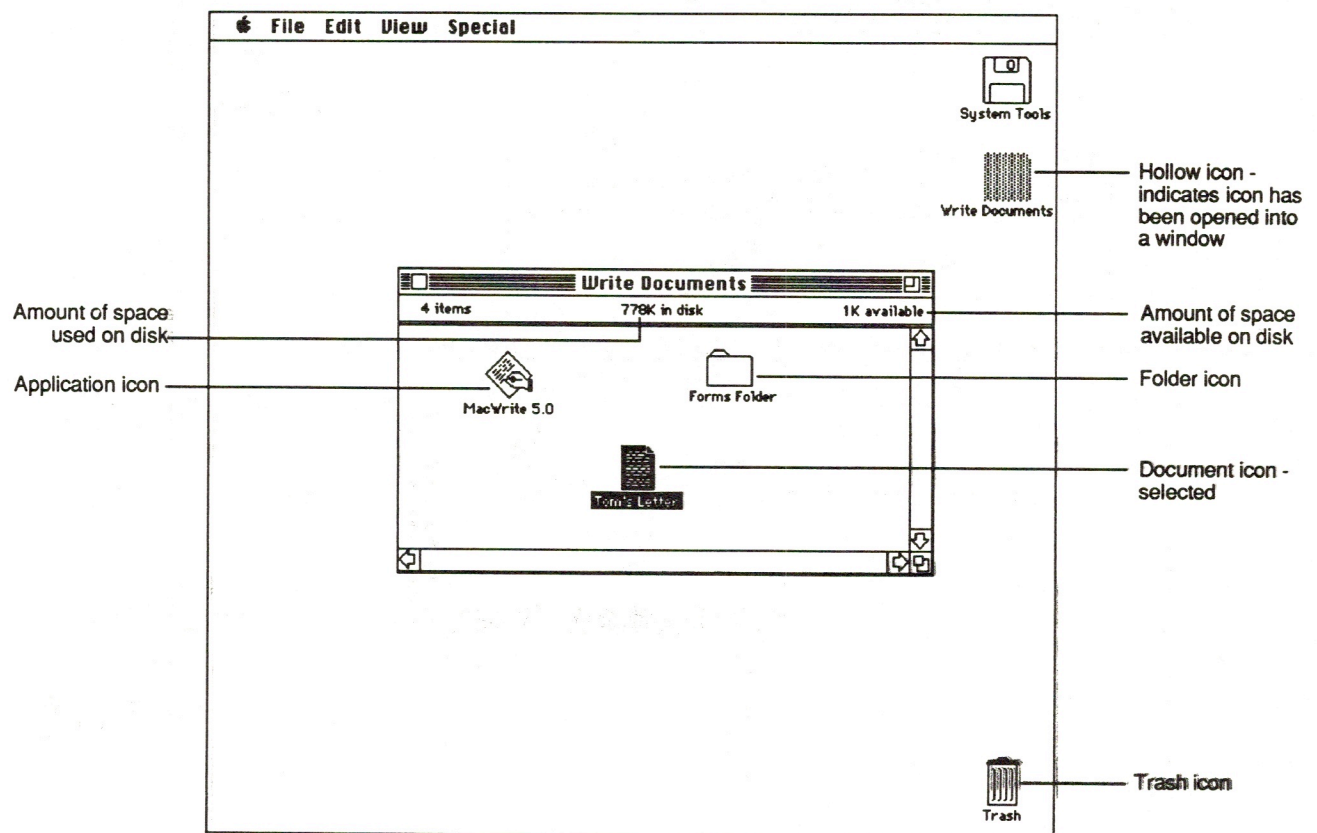


Figure 2. Desktop features and commands

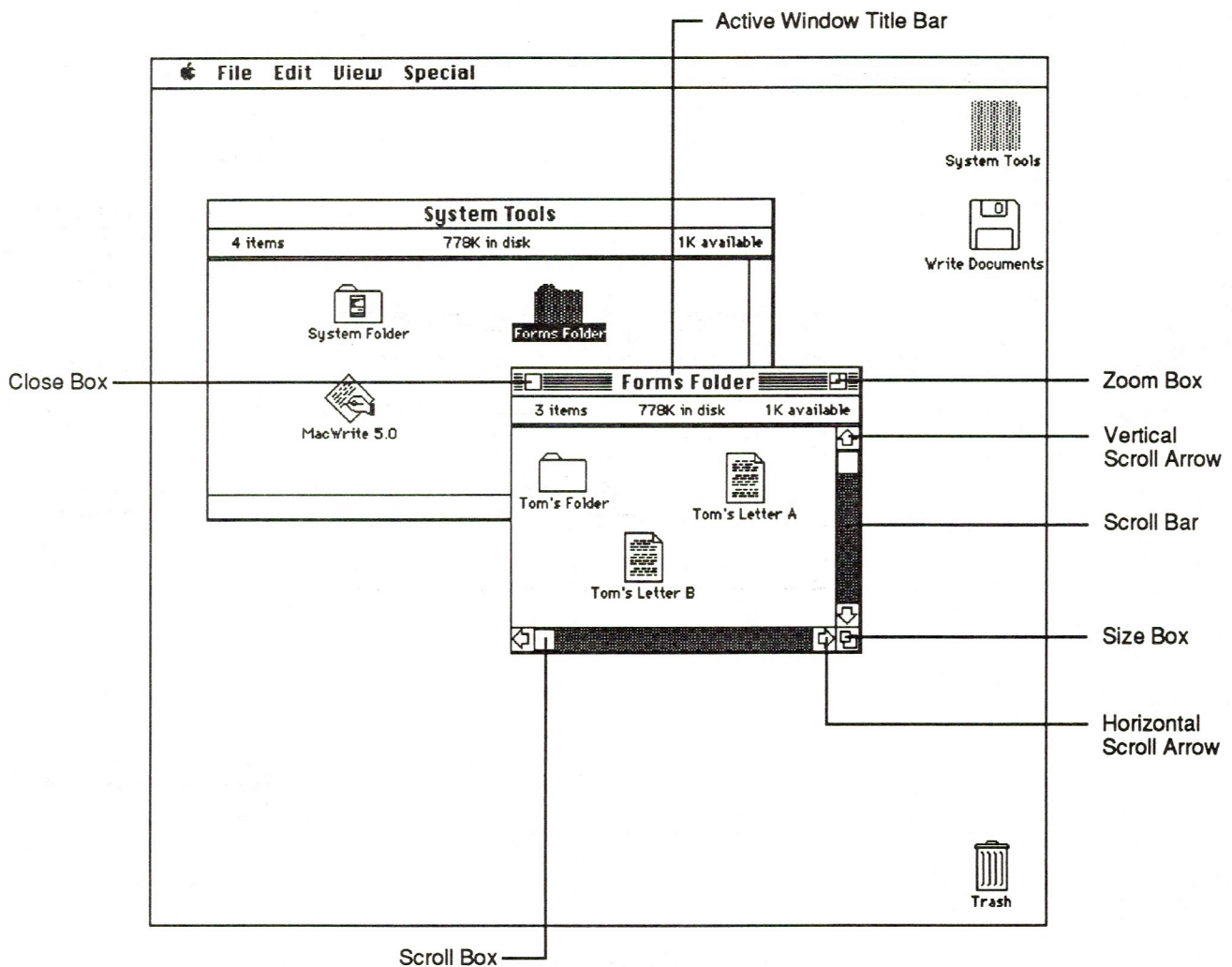


Figure 3. Desktop features and commands

## Review of Macintosh Commands

The following summarizes basic commands used on the Macintosh desktop:

### Selecting an icon

To select an icon, point to it and click the mouse button.

To deselect an icon, select another item on the desktop or point anywhere else on the screen and click the mouse button.

### Moving Icons

To move an icon:

1. Point to the icon.
2. Press and hold the mouse button.
3. Drag the icon to place it where you want it.
4. Release the mouse button.

### Selecting More Than One Icon

To select more than one icon when they are grouped together:

1. Position the pointer outside one corner of a group of icons.
2. Drag to the opposite corner.

Holding the Shift key down while you click a selected icon deselects it.

To select more than one icon when they aren't grouped together:

1. Select one icon by clicking.
2. Hold down the Shift key while you continue to select icons by clicking or dragging.

### Opening an Icon

To open an icon (disk, folder, file, or application), double-click on the icon or:

1. Select the icon.
2. Choose Open from the File menu.

### Choosing from a Menu

To choose from a menu:

1. Point to a menu.
2. Press the button and hold it down. The list appears.
3. Drag the pointer down the list.
4. When you have highlighted the choice you want, release the mouse button to activate the menu selection.

If menu choices are dimmed, they are inappropriate for the moment and you can't select them.

### Moving a Window

To move a window to a new position, place the pointer on the window's title bar and drag the window to the new position.

### Making a Window Active

If you have more than one window displayed, you can activate a window by clicking in any part of it. (An active window has horizontal lines in the title bar.)

### Changing the Size of a Window

To change the size of a window:

1. Point to the size box.
2. Press and hold the mouse button.
3. Drag the box until the window is the desired size.

Clicking in the zoom box pops the window back to full size. If you click in the zoom box again, the window returns to the previous size.

### Scrolling a Window

A shaded scroll bar indicates that the window has more contents than are currently displayed.

To scroll line by line, click the scroll arrow that points in the direction of what you want to see (up/down or right/left). You can scroll continuously line by line by pressing the scroll arrow rather than clicking it.

To scroll by the windowful, click in the gray area of the scroll bar. You can scroll continuously by the windowful by pressing in the gray area of the scroll bar.

To scroll more quickly, drag the scroll box along the scroll bar.

**Closing a Window**

To close a window, click in the Close box or choose Close from the File menu.

**Nesting Documents & Folders**

Create a new folder by selecting New Folder from the File menu.

To place documents in a folder, drag the document icons to the folder. Release the mouse button when the folder is highlighted. Nest folders in other folders in the same way.

**Deleting Documents**

To eliminate a document from the desktop, drag the document icon to the trash can.

If the trash can is bulging, you can retrieve documents from it. Select the trash can and choose Open from the File menu.

Once the trash is emptied, its contents are permanently erased. The trash empties if:

- You choose Empty Trash from the Special menu
- You leave the desktop to enter an application
- You use the Shut Down menu item to turn off the computer
- The Macintosh needs more memory to work with and gets it by emptying the Trash

**Note:** *In System 7.0 the trash empties only when:*

- You choose Empty Trash from the Special menu

**Continue with the next section - Using a Macintosh Application.**

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# Using a Macintosh Application

## Overview

In this exercise, you will learn more about working with Macintosh applications. The exercise directions assume that you are using a Macintosh SE, but the tasks you will perform are the same for all Macintosh computers.

The information, skills, and practice you will gain in this exercise are critical to your ability to interact with users, to understand the problems users encounter, and to recreate problems.

Specifically, you will practice typical tasks involved such as creating, saving, editing, and deleting a document. You will also learn more about using the hierarchical file system.

## What You Need

For this exercise, you will need to provide:

- a Macintosh SE, set up with keyboard and mouse
- a *Macintosh System Tools* Disk

## TeachText

For this exercise, you will use a sample application called TeachText. TeachText is a text editor—a very basic writing application provided on the *Macintosh System Tools* disk (the disk that you will use to boot the system).

Any start up disk such as the *Macintosh System Tools* disk, must contain a System Folder in order for computer to start up and to run.

1. Boot (start up) the Macintosh by inserting the *Macintosh System Tools* disk and switching on the computer.

If the system you are using has an internal hard disk that has been configured, the system will automatically boot from the hard disk when you turn on the power. If the hard disk has not been configured, you can insert the *System Tools* disk into the drive after the system powers on. If the system is already on and the hard disk is not configured, you will see a blinking question mark indicating that you should insert the *System Tools* disk.

2. Open the TeachText icon.

You will see the TeachText screen with an empty window ready for you to type in some text as shown in Figure 4.

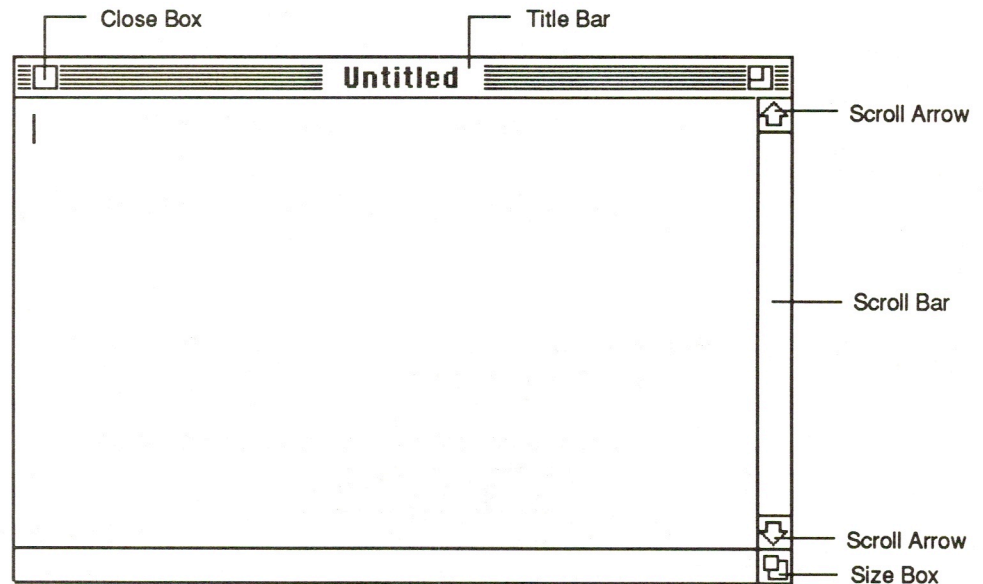


Figure 4. TeachText startup window

Like most applications, TeachText has its own menus, a title bar, a close box, a size box, and a scroll bar. Also like most applications, TeachText always opens with an "Untitled" window. You name the document when you save it.

### Creating a New Document

First, a quick review of some of the basics covered in the Tour Disk. The vertical blinking bar marks the **insertion point**, where the text you type will be inserted. If you make a mistake use the **delete** key (sometimes labeled Backspace) to erase characters and then start typing again. When your typing reaches the end of the line, it will automatically **wrap around** to the next line. If you want to start a new line, press the **return** key.

1. Use the keyboard to type the following:

*They service Macintosh computers. They also sell applications.*

## Saving a Document

As you type, the system places the data in temporary storage (in RAM). To permanently store the document, you need to **Save** it. Saving a document stores it on the disk. Each time you save a document, the new version replaces the old version on the disk.

1. Choose Save from the File menu.

A dialog box appears, as shown in Figure 5.

**Note:** *If you are using System 7.0, your screen will appear slightly different.*

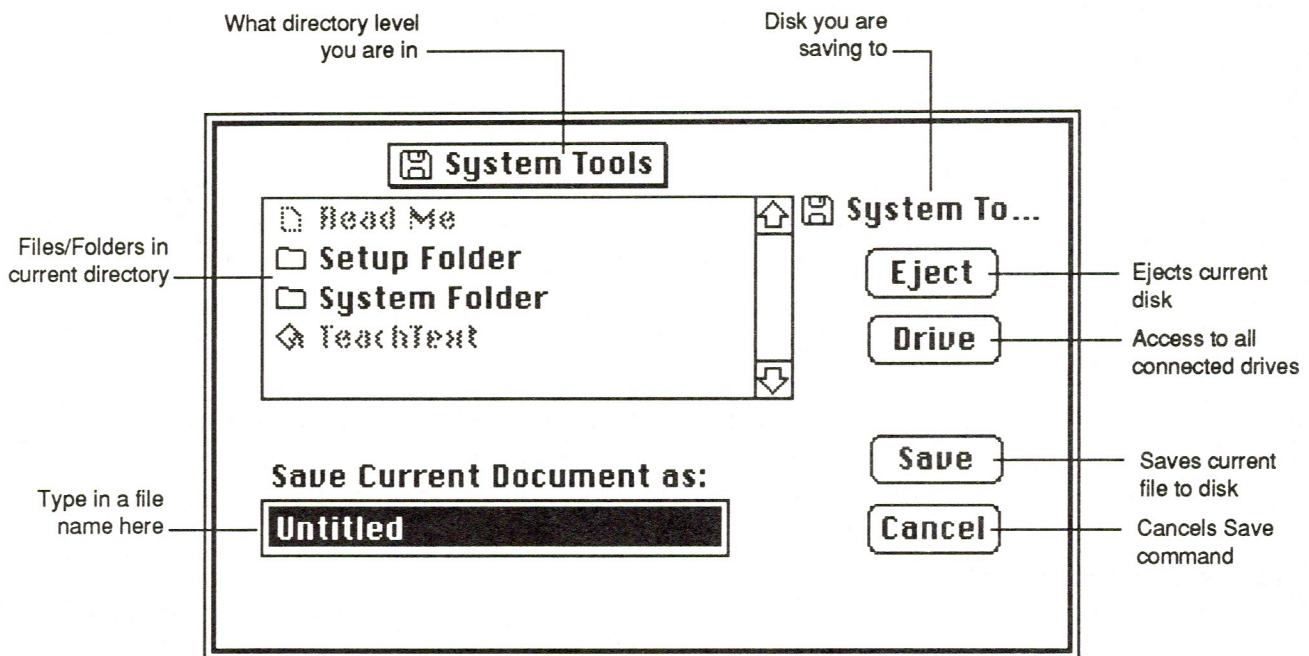


Figure 5. The Save Dialog box

## Dialog Boxes

Whenever the Macintosh needs more information from you, it presents a dialog box with buttons to click, such as OK or Cancel. (Dialog boxes are sometimes called standard control boxes.) Some dialog boxes provide a place for you to type additional information. Dialog boxes can also alert you if you are about to do something that could cause you to lose information; they give you a chance to cancel what you were

about to do. Dialog boxes are often accompanied by a beep.

The Save Dialog box gives you the chance to save your document on any disk. Note the text box in which you type the name of the document. The word "untitled" remains in the text box until you enter a name for the document and save it.

You will save the document with the name "First Note." For now, save the document directly on the System Tools disk without placing it inside a folder.

2. Type *First Note* to name the document.

Note that the characters you type replace the word "untitled."

3. Click the Save button.

Your document is saved on the disk just as it appears on the screen. When the document window is reactivated, the title bar shows the name you just gave to the document.

### **Save Work Frequently**

When working on documents, you should choose the Save command from the File menu frequently (about every 15 minutes or so). That way, if the Macintosh gets switched off or there's a power failure, you lose only a few minutes of work.

### **The New Document on the Desktop**

When you named and saved the document, you created a new file on the disk.

4. Choose Quit from the File menu.

The desktop appears again, but now the icon of your new document appears in the System Tools window, as shown in Figure 6. (Your window may differ slightly.)

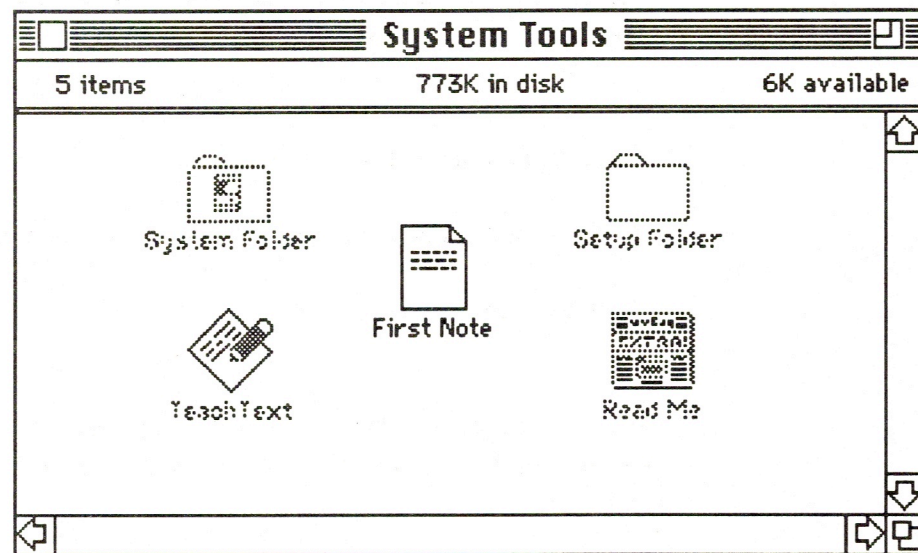


Figure 6. Window showing icon for the newly created TeachText document

## Document Icons

All documents you create have an icon particular to the application you used to create them, so you can tell which application you used to create each document. For example, all documents created with TeachText are represented by this icon:



Figure 7. TeachText document icon

When you want to work on this document again, you will select and open the icon just like any other icon.

5. Open the "First Note" document you just created by double-clicking on it.

Opening the document you want to work on also starts the application that created it. You do not have to open the application before opening the document; once a document has been saved, you can open it directly from the desktop.

### Editing a Document

6. Select the first sentence by placing the pointer in front of the first letter of the sentence, pressing the mouse button, and dragging the pointer to the end of the sentence.

The sentence will then be highlighted.

7. Choose Cut from the Edit menu.

The sentence will disappear. It is being held temporarily in the Clipboard, ready for you to paste it to a different location.

If you pull down the Window menu and choose Show Clipboard, you can see what it is holding.

8. Now select the new insertion point by clicking after the period that ends the remaining sentence.
9. Insert two spaces by pressing the space bar twice.
10. Choose Paste from the Edit menu.

The contents of the Clipboard—in this case, the sentence you just cut—are pasted into the location indicated by the cursor.

The contents stay on the Clipboard until you choose Cut or Copy again.

Your document now looks like the sample shown in Figure 8.

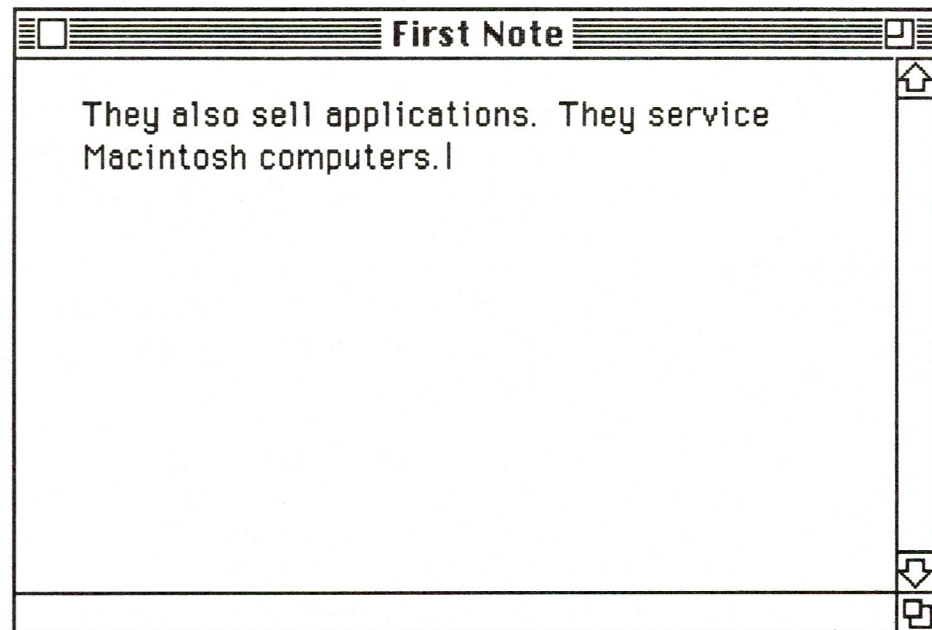


Figure 8. Note with first revision

11. Select the word *also* by double-clicking on it. Notice the the entire word is highlighted when you double-click on it.
12. Choose Cut from the Edit menu. The word replaces what was previously on the Clipboard and is ready for pasting somewhere else.
13. Place the insertion point just before the word *service* in the second sentence.
14. Choose Paste from the Edit menu. The word *also* is pasted in the sentence where the pointer was.

15. If necessary, insert a space between words by using the space bar.

Your document now looks like the text in Figure 9.

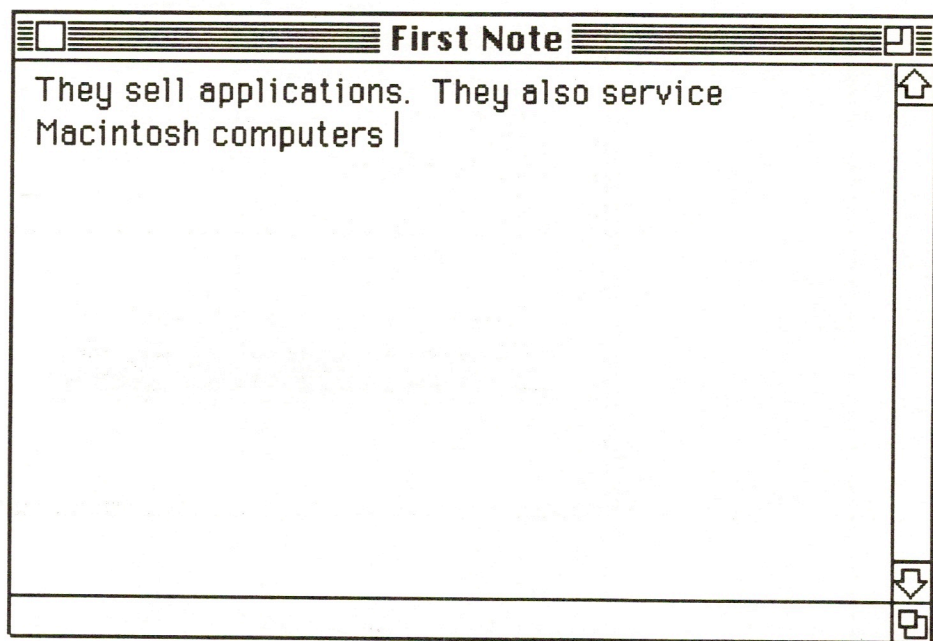


Figure 9. Note with second revision

### **Saving a Document with a Different Name**

Now that you have changed your original memo, you need to save your revision. You have two choices for saving. You can choose Save from the File menu, and the revised document will be saved with the same name and will replace the contents of the original document. Or by choosing Save As, you can save the revision as a new document, thus keeping the original document without any changes.

16. Choose Save As from the File menu.

A dialog box appears. (It is the same one you saw when you named your first memo.) The name of the original document is highlighted in the text box, as shown in Figure 10.

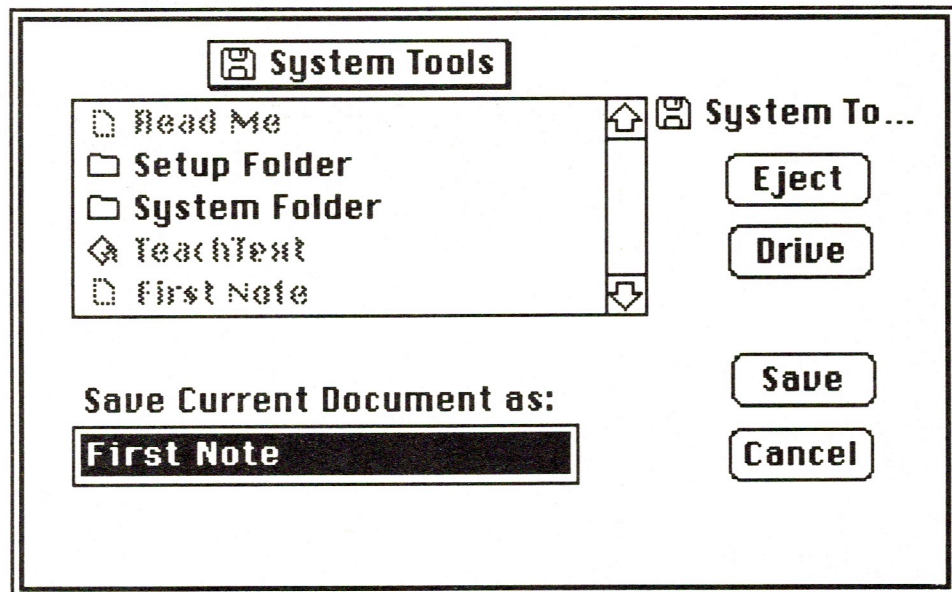


Figure 10. Save-as dialog box

To save this document as a new document, you need to type in a new name. You can edit the existing name just as you would edit other text. Or you can just type a new name for the document.

17. Select the word *First* by positioning the pointer at the beginning of the word and dragging to the end of the word.
18. Type *Second*.
19. Click Save

You have saved the revised document with a new name and you return to the document you just renamed. Notice that the title bar changes to show the "Second Note" memo. Your original document is still saved, unaltered, with its own name.

20. Choose Quit from the File menu.

You return to the desktop where you see an icon for the revised document with the name you just gave it, as shown in Figure 11. (Your window may differ slightly.)

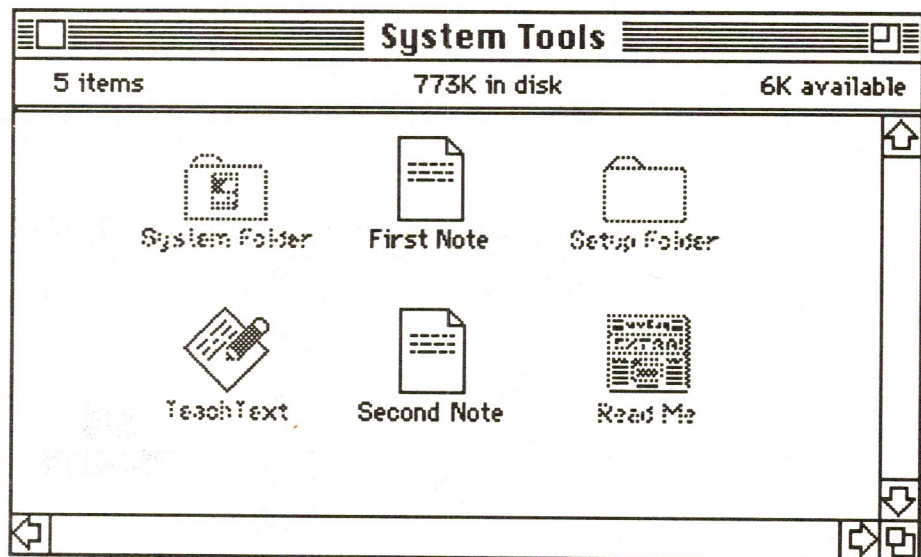


Figure 11. Desktop showing the revised document

### What You Have Learned So Far

So far in this exercise, you have started the TeachText application from the desktop and opened a document. You have used the TeachText application to create and save a file. Later, when you opened the file, you automatically opened the TeachText application. You edited the file and saved it as a new file.

## Using Folders

The Finder also helps you to organize your documents—to group them together with related documents, duplicate them, rename them, or throw them away.

Macintosh folders, just like ordinary folders, allow you to keep related documents together. You already have one or two folders on the *Macintosh System Tools* disk. To organize your own work, you have an endless supply of empty folders.

## Creating a New Folder

21. Create a new folder by choosing New Folder from the File menu.

A folder named *Empty Folder* appears in the System Tools window, as shown in Figure 12.

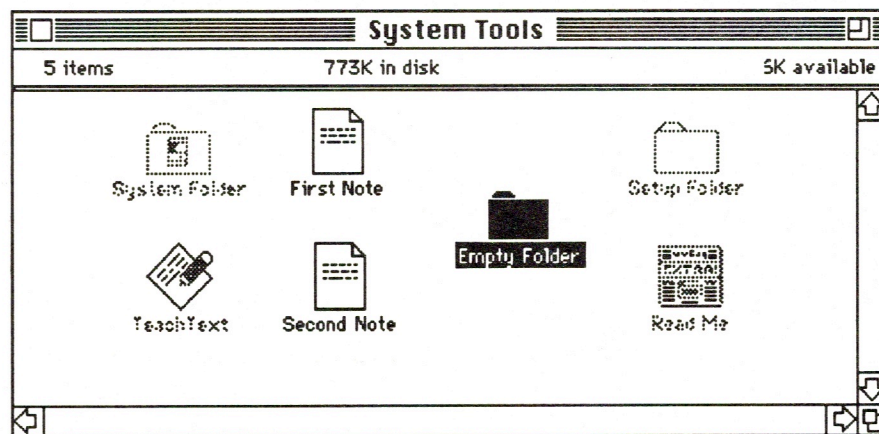


Figure 12. System Tools window with a new folder

### Renaming a Folder

Before you can rename a folder, it must be selected (highlighted). A newly created folder is automatically selected when you create it, so you can rename it just by typing. (If you cannot see the entire icon, you can make the window larger, move the icon, or scroll to see it.) If the empty folder is not highlighted, click once on it to select it.

23. Type *Notes Folder* and press Return.

Pressing Return confirms your new folder name. *Empty Folder* is renamed *Notes Folder*.

### Nesting Files in Folders

Place the two documents you just created in the Notes Folder:

24. Drag the First Note icon to the Notes Folder icon, releasing the mouse button when the Notes Folder icon is highlighted.

When you cover the folder icon with the outline of the document icon, the folder icon is highlighted. When you “drop” the document icon into the folder by releasing the mouse button, the folder icon is no longer highlighted, and your document icon disappears into the folder.

25. Drag the Second Note icon to the Notes Folder icon.
26. Open the Notes Folder icon to check its contents.

You see the icons for your two documents.

### Nesting Folders

Large-capacity disks—like hard disks—can hold hundreds of documents and folders. At some point, you may find it helpful to place folders within other folders to keep your work organized.

27. Close the Notes Folder window if it is not already closed.
28. Choose New Folder from the File menu.

You see an empty folder in the System Tools window.

29. Name the new folder by typing TeachText Folder and then pressing Return.

Depending on the length of the names you give your documents and folders, names may occasionally overlap and obscure each other. To read the name, you can select the icon or drag it to a different position in the window.

30. Put the Notes Folder icon and the TeachText icon into the TeachText Folder.

31. Open the TeachText Folder.

You see both the TeachText application icon and the Notes Folder in the TeachText Folder window.

32. Open the Notes Folder.

Notice that each folder has its own window. The active window is the folder you just opened. (You can still change the active window by clicking anywhere in another window.)

33. Close the Notes Folder and then the TeachText Folder.

As you close each folder's window, it collapses back into the icon of the previous window until you reach the System Tools window.

Placing folders within folders is called **nesting**. You can continue nesting folders as deep as you want, but having too many levels may become awkward. You can always find any application, document, or folder by using **Find File**, a desk accessory designed to help you keep track of the contents of large-capacity disks.

### Hierarchical File System

When you nest folders, you create a hierarchy. When all of the folders on a disk are closed, and the disk directory window is open, you're looking at the top level of the hierarchy, as shown in Figure 13. (Your window may differ slightly.)

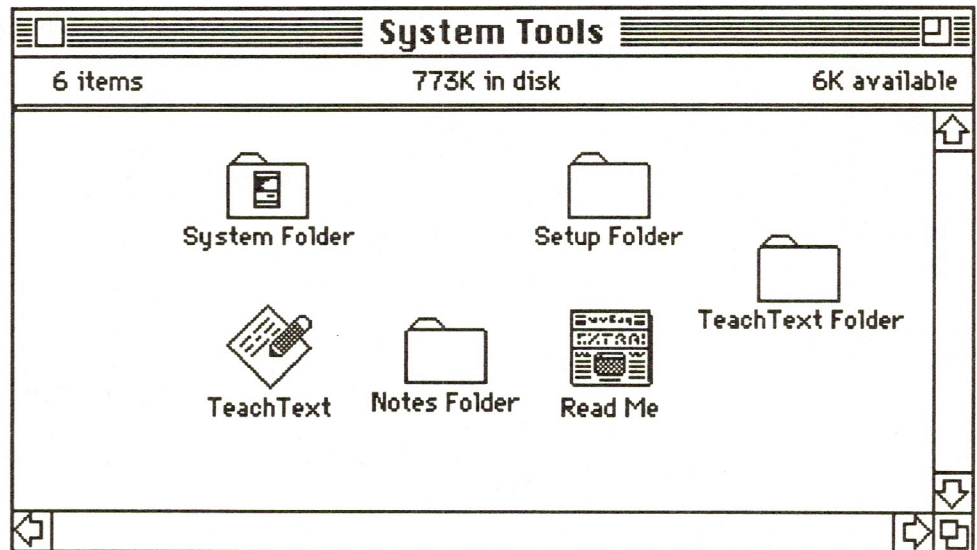


Figure 13. The top level of the hierarchy

When you open a folder on the top level, the folder's directory window shows you the second level of the hierarchy.

34. Open the TeachText Folder again.

You see the second level of the hierarchy, as shown in Figure 14.

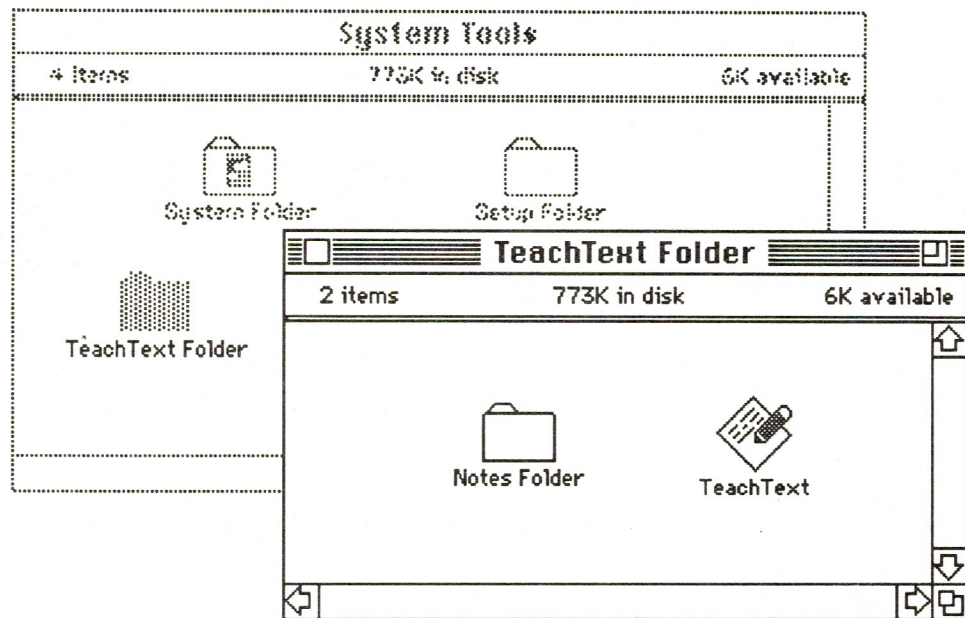


Figure 14. The second level of the hierarchy created in this exercise

If there is a folder in that second level—in this case, the Notes Folder—and you open it, you see the third level, and so on.

35. Open the Notes Folder.

You see the third level of the hierarchy—the two memos—as shown in Figure 15.

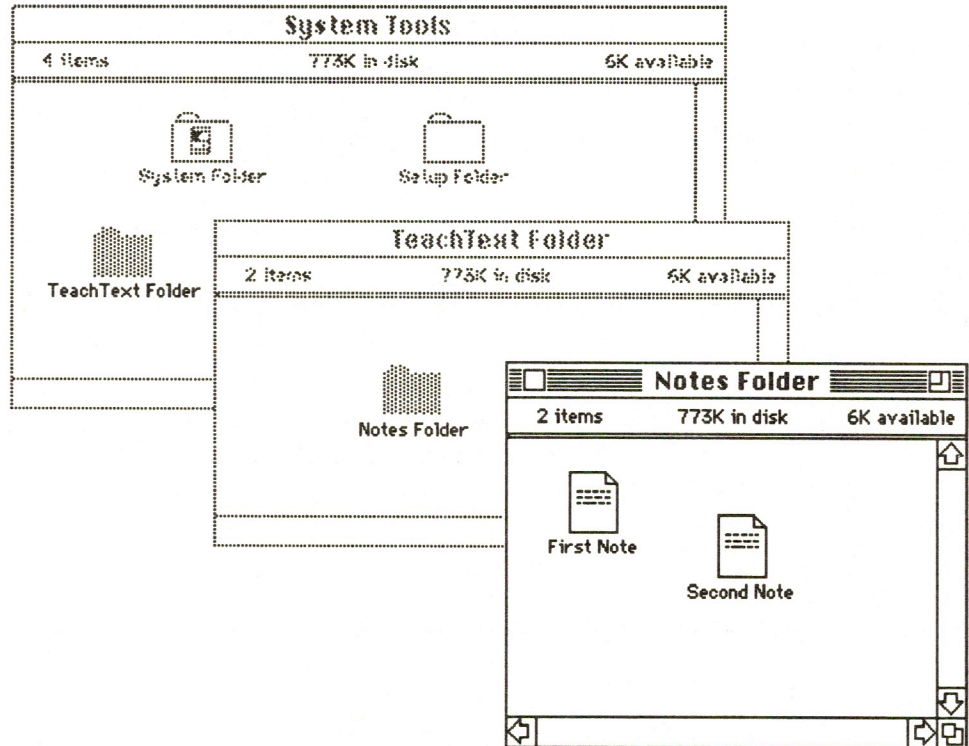


Figure 15. The third level of hierarchy created in this exercise

### Working with the Hierarchical File System

When you are working with an application, you don't have to quit the application and use the Finder to go back and forth through all those folder windows whenever you want to open a new document. You can open and save documents within an application. You can even open up documents from another disk without leaving the application.

36. Close the Notes Folder if it is not already closed.
37. Open the TeachText icon.
38. Close the Untitled window. Either click the close box or choose Close from the File menu. Don't start a new document right now.
39. Choose Open from the File menu.

You should see the dialog box shown in Figure 16.

**Note:** Depending on the version of system software you are using, the files and folders shown in the Open dialog box may differ slightly.

A directory title shows you the name of the folder you're presently working in—in this case, the TeachText Folder. The box beneath it shows you all the other items in the TeachText Folder that you can open with the application—in this case, only the Notes Folder.

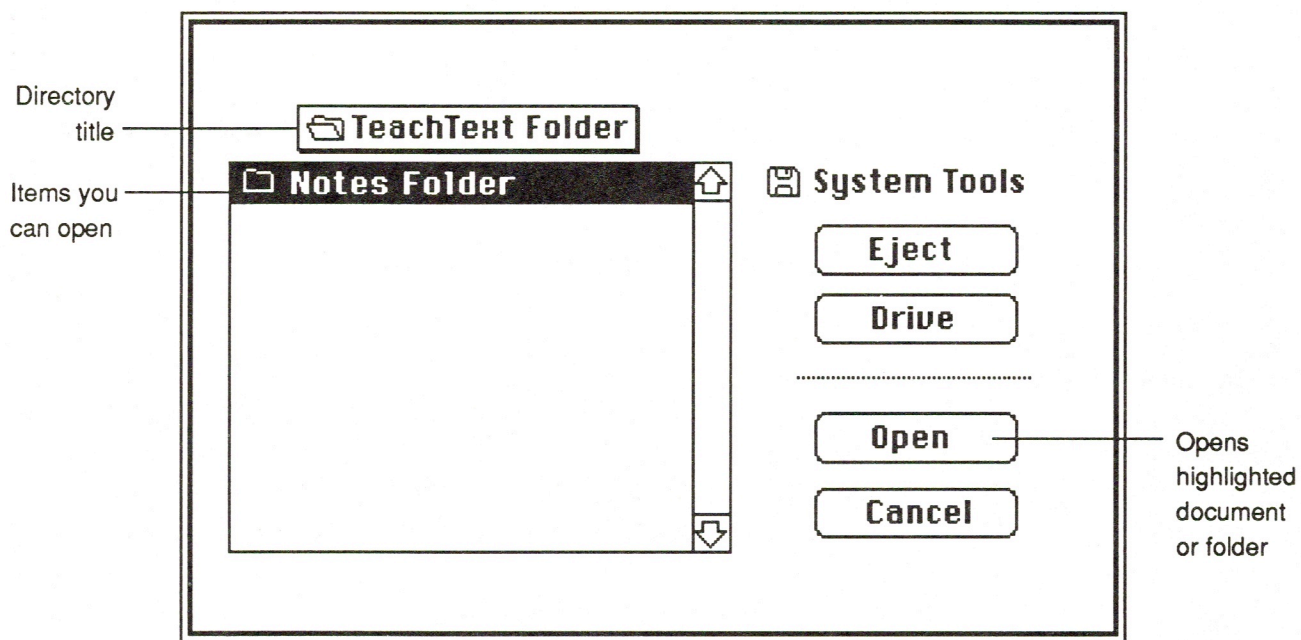


Figure 16. Dialog box for opening a document

40. To open the Notes Folder, click Open

As you open the Notes Folder, you move down through the hierarchy to the third level where your notes documents are located, as shown in Figure 17.

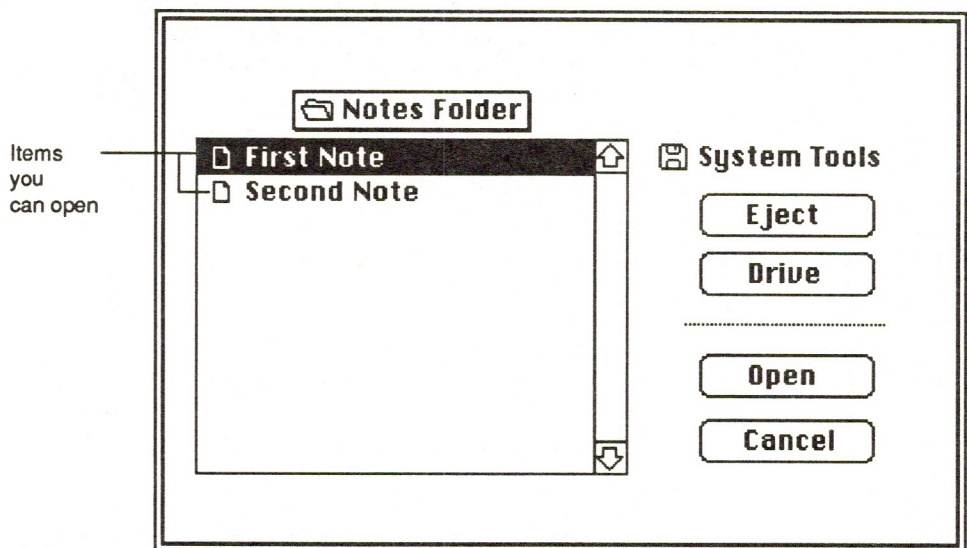


Figure 17. Dialog box showing items that can be opened within the Notes Folder

The directory title changes to remind you where you are in the hierarchy, and the box shows you what's in the Notes Folder. The selected document (the document that is highlighted) is the one that will open when you click Open. If you want to open the other document, click anywhere on the other document's name to highlight it, and then click Open.

If you want to open a document that's located somewhere else in the hierarchy, you can move to another level by clicking the directory title, as shown in Figure 18.

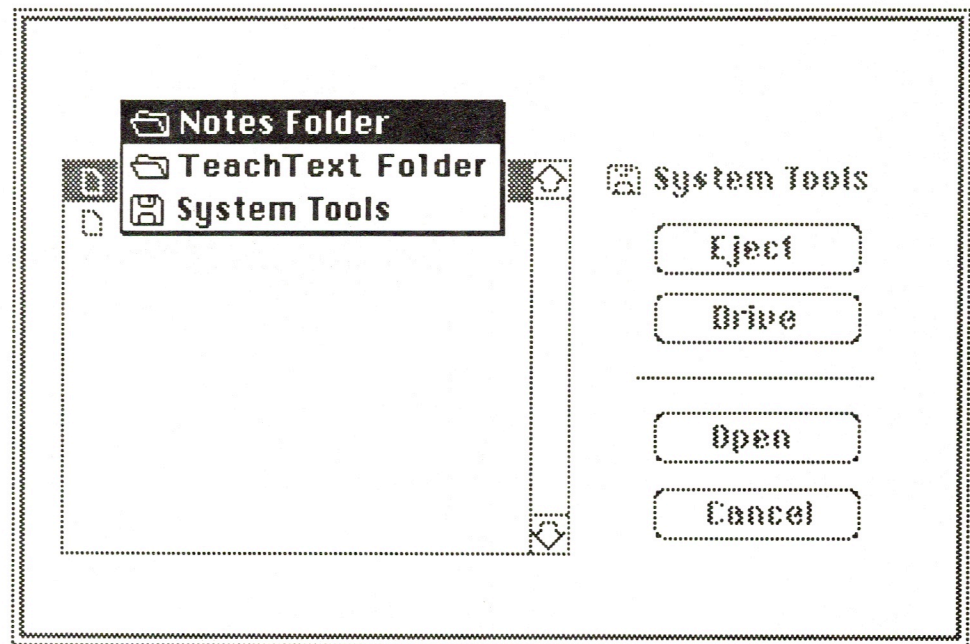


Figure 18. Directory title menu pulled down

41. Position the pointer on the directory title and press and hold down the mouse button.

This pull-down list is similar to the menus you used earlier, except rather than showing commands, this list shows the path through the hierarchy back to the top level. (The top level is always the last on the list.) You choose the level you want by dragging down the menu and selecting it.

42. Choose the TeachText Folder, as shown in Figure 19.

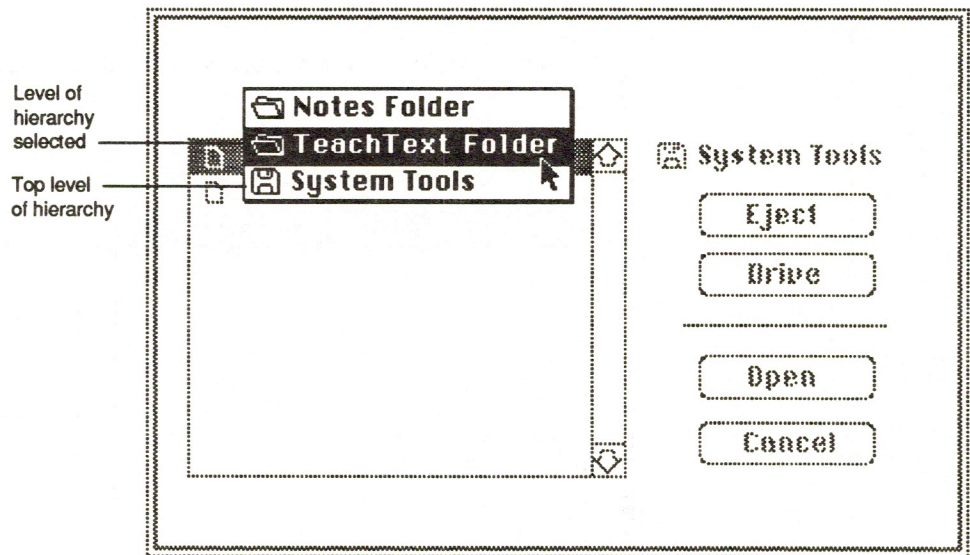


Figure 19. Selecting the TeachText Folder in the dialog box

The directory title changes again, and you see the contents of the TeachText Folder in the box—the Notes Folder—as shown in Figure 20.

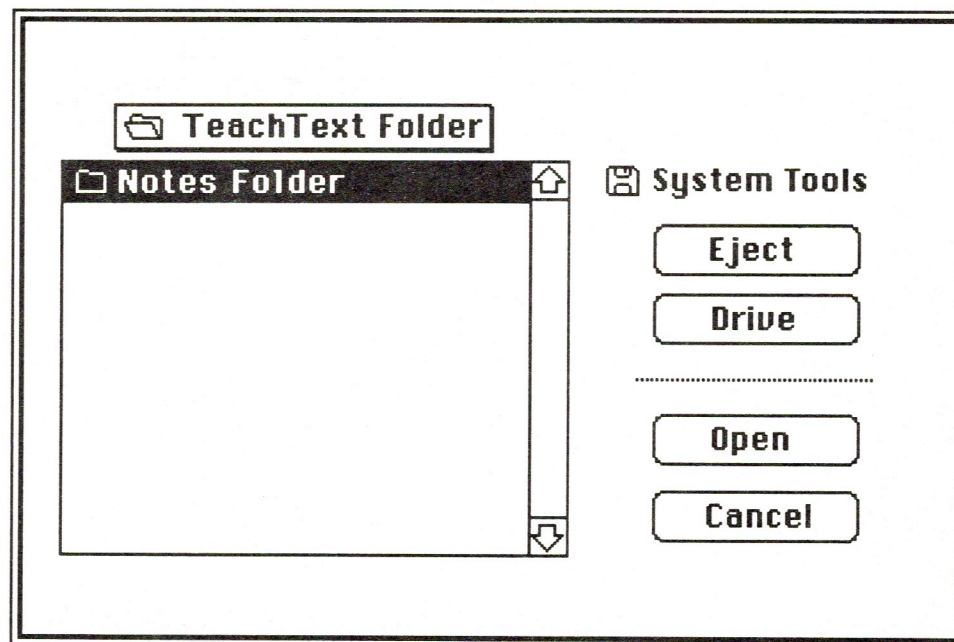


Figure 20. Directory title showing the TeachText Folder contents

43. Pull down the list below the directory title again and choose System Tools.

The menu changes again, and you see the folders on the top level of the hierarchy—in this case, the System folder, the TeachText Folder, the Update Folder, and the Utilities Folder.

So far, all you have seen in the window are folders and the documents you can open with the application TeachText. When you open a document from within an application, the dialog box shows you only folders and documents that you can open with that application. If you open a folder and you don't see anything listed in the window, that's because that folder doesn't contain anything you can open with the application you're using.

### Accessing Another Disk

You've been moving through the hierarchy on the System Tools disk. For now, you will work only on this disk, but if you wanted to open a document on another disk, you could see what's on the other disk by clicking the Drive button in the dialog box, as shown in Figure 21.

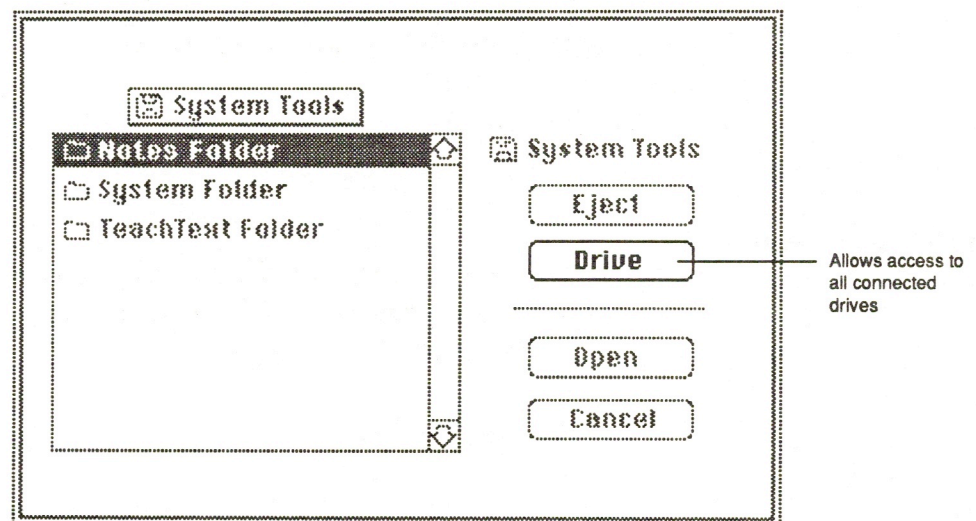


Figure 21. The Drive button

**Note:** *If you do not have a disk in another drive, the Drive button appears dimmed.*

When you click the Drive button, you see the name of the disk change in the upper-right corner of the dialog box, and you see the folders and documents on the top level of that disk in the window.

If you have a one-drive system, or if you just want to switch disks in a disk drive, you can click the Eject button. This ejects the disk from the drive and lets you insert another disk. The new disk's name appears in the upper-right corner of the dialog box, along with its folders and documents in the window.

### Switching Work Disks

This ability to switch to other disks while within an application is especially useful to users who are working without a hard disk.

Users who are working with floppy disk drives usually work with two kinds of disks: application disks and work disks (or document disks). Users add the required startup files to their application disks so they can boot their systems from these disks. The startup files and typical applications take up so much disk space, that users generally need to use other disks for working on and storing documents. These other disks become the users' work disks or document disks.

44. Quit TeachText.

### Deleting Documents

You can delete documents, folders, and even applications by dragging their icons to the trash can. You may want to delete the two documents you created in this exercise. Be careful not to trash the TeachText application .

45. Open TeachText Folder.

46. Reduce the size of the TeachText folder window so that you can see more of the System Tools window.

47. Drag the TeachText icon (the application) from the TeachText Folder over to the System Tools Directory Window. This removes the application from the TeachText Folder and puts it back at the top level where it was when you started this exercise.

48. Close the TeachText Folder.

49. Delete the TeachText Folder by dragging it to the trash can. **(Do this only if you have placed the TeachText application back in the System Tools Directory window.)**

## Turning off the System

That is all for this exercise. If you want to continue with the next step, another hands-on exercise, leave your system on. Otherwise, shut it down:

50. Close all windows.
51. Choose Shut Down from the Special Menu.

The computer should eject the System Tools disk from the disk drive.

When the shut-down dialog box appears, as shown in Figure 22, you can turn off the power. (Macintosh II computers actually power down when you choose Shut Down.)

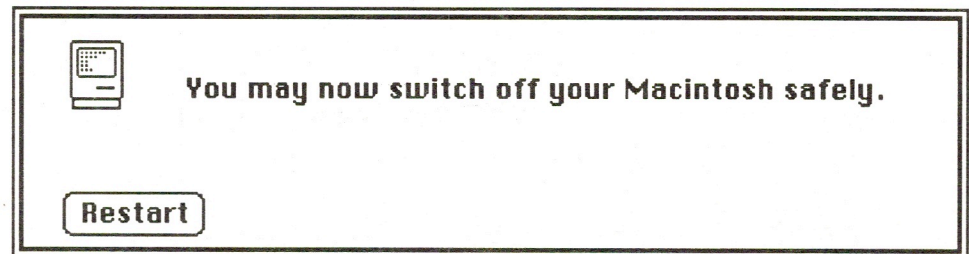


Figure 22. Shut Down dialog box

**Important:** *Always choose Shut Down from the Special menu before switching off your computer. When you choose Shut Down, the computer puts everything away safely, empties the trash, and updates directory information before you switch off the system.*

Continue with the next section - Introduction to Macintosh Software.

# Introduction to Macintosh Software

## How the System Software Is Organized

Macintosh computers are easy to use partly because of the Macintosh system software design. Figure 23 is a simplified diagram of the relationship between the Macintosh users, the Macintosh software components, and the Macintosh hardware.

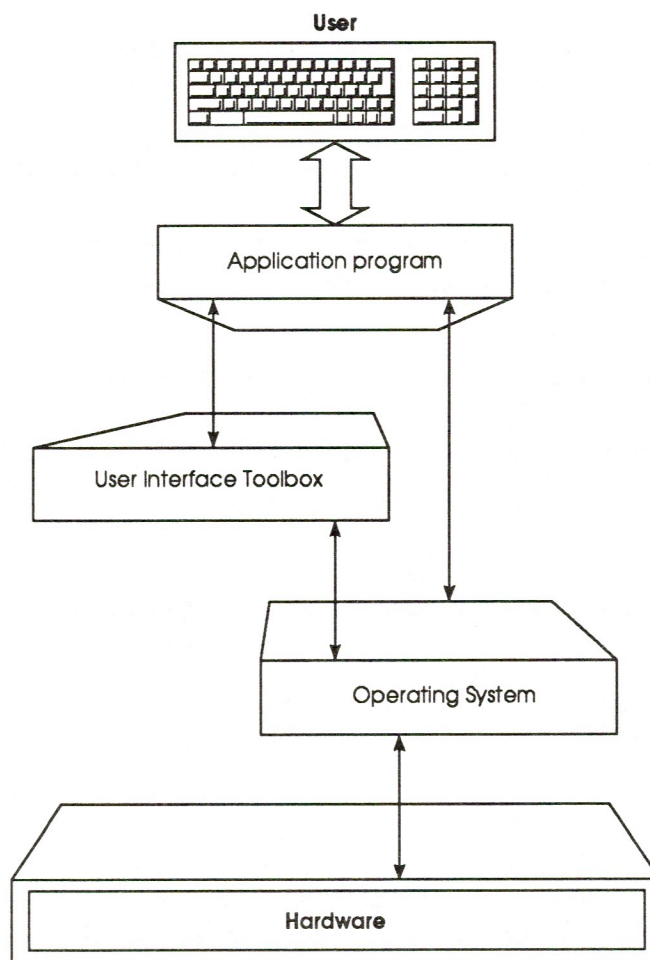


Figure 23. Relationship between Macintosh users, software components, and hardware

As illustrated in Figure 23, users work directly with the application programs that run on the Macintosh. Many computers force users to recall complicated commands because users work directly with the operating system. Macintosh users never work directly with the operating system; they work with applications.

The applications, in turn, interact directly with lower levels of software—the **User Interface Toolbox** and **Operating System**. The Operating System interacts with the system hardware.

The following will give you more details about these parts of the Macintosh software and will explain other basic Macintosh software terms. This information is common to all Macintosh computers.

## Applications

In general, the term *application* refers to software programs that users work with. There are two kinds of Macintosh applications:

- **Applications** (a more specific use of the term) are stand-alone programs that take control of the computer when they are launched. All of the familiar Macintosh programs—word processors like MacWrite and graphics programs like MacPaint—are applications developed by third-parties.
- **Desk Accessories (DAs)**, such as the Control Panel, are mini-applications that can be run from within an application. Six standard and three optional DAs come with the Macintosh. Additional DAs can be purchased from third-party developers. You will learn more about DAs later in this module.

All applications and DAs written by third-party developers are created using Apple's system software and standard development tools.

## Toolbox

The User Interface Toolbox ("the Toolbox") is an organized set of data and instructions (**routines**) that provides a standard user interface to all Macintosh applications. It is the Toolbox that creates the pull-down menus, windows, dialog boxes, and standard control features. The Toolbox allows application developers to draw from a consistent set of menus, windows, and other routines, so that their programs look and work like all other Macintosh applications.

**QuickDraw**, part of the Toolbox, performs all screen display operations. Applications and other parts of the Toolbox use the QuickDraw routines to draw graphics and text on the screen.

## Operating System

The Operating System provides the interface between the applications and the computer hardware. Software routines in the Operating System perform basic tasks such as receiving input, controlling output, and managing memory.

Note that although both the Operating System and the Toolbox contain a series of software routines, they are separated by function; the Toolbox maintains a consistent user interface while the Operating System handles system level tasks such as input, output, and memory management.

### Resources

**Resources** form the foundation of all Macintosh software programs. Resources are chunks of data that are used by the various programs of the Macintosh system. For example, every menu, font, and icon is stored as a Resource.

Resources make it easy for users and developers to manipulate portions of application programs. For example when you add or remove a font from your startup disk, you are manipulating a resource—the font.

Standard resources that are shared by all applications and by the Macintosh Toolbox and Operating System are kept together in the **System file** (which you will learn more about later).

### Managers

Within the Toolbox and Operating System, routines are divided according to function into a set of software **Managers**. For instance, the Window Manager handles the display and manipulation of windows on the Macintosh screen. The Resource Manager locates and delivers the resources needed by a program.

Both the Toolbox and the Operating System contain managers.

### Device Drivers

A **device** is a part of the Macintosh or a piece of external equipment that can transfer information into or out of the computer. Macintosh devices include disk drives, input/output (I/O) ports, and printers.

Applications communicate with devices through a set of routines called the **Device Manager**. The Device Manager calls upon **device drivers** to manipulate the devices. Device drivers are programs that take data coming from the Device Manager and convert them into actions by the device or convert device actions into data for the Device Manager to process. Figure 24 illustrates the general flow of information between the computer and devices.

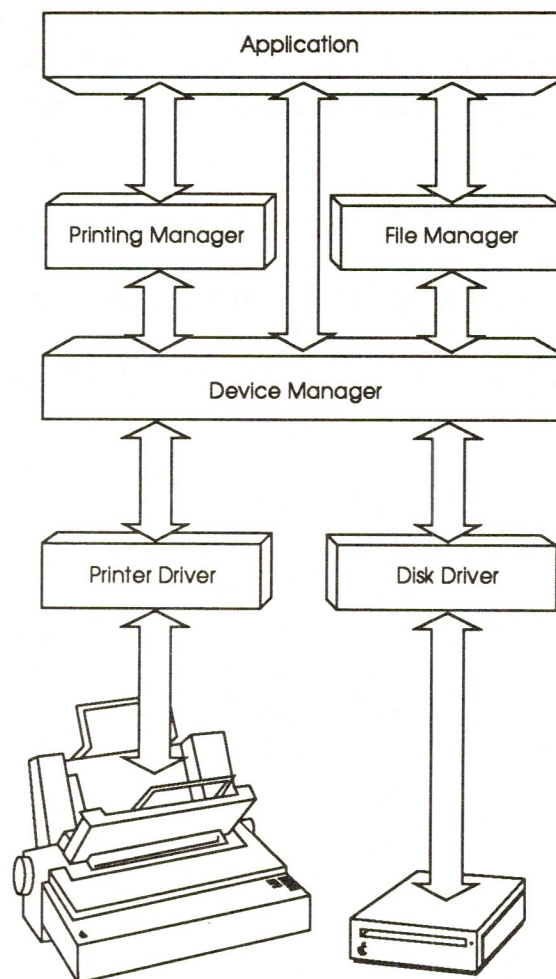


Figure 24. Flow of information between the computer and devices

Some standard device drivers, for example, 3.5-inch disk drivers, are built into Macintosh ROM. Others drivers, for example, printer drivers, are provided in the System Folder or are supplied by third-party developers.

### Where the System Software Is Contained

The Macintosh stores system software in two types of memory: Read Only Memory (ROM) and Random Access Memory (RAM).

Most of the Toolbox and sections of the Operating System are contained permanently in ROM. This type of system software, which is built into the hardware, is called **firmware**.

In between major ROM revisions, new routines and corrected versions of old routines are provided by updates to the system software. These updates are provided on the System Tools disk (specifically the System and Finder files, device drivers and other resources found in the System Folder). When a system boots up, it loads the data from the System Folder and places the data in RAM, where it is stored until the system is shut down.

**Putting It All Together**

Figure 25 summarizes the interrelationship of the Macintosh software parts that were described in this section.

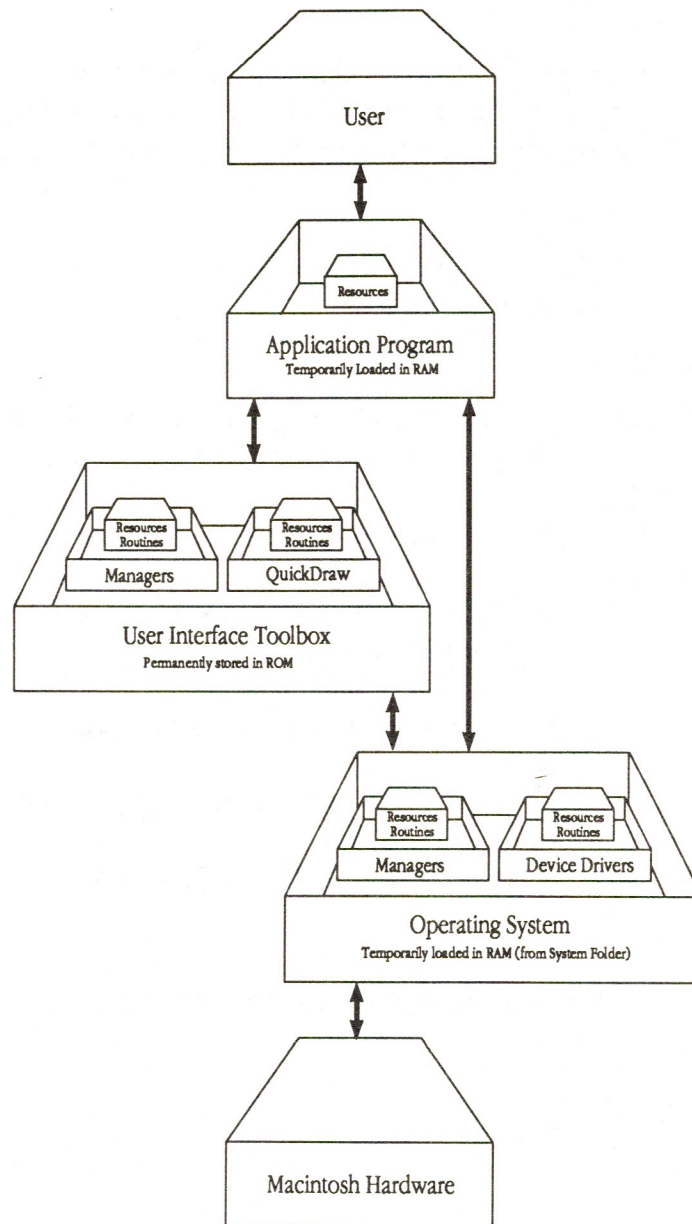


Figure 25. Summary of the interrelationship of the Macintosh software parts

**Continue with the next section - Exercise: Macintosh Software Components**

---

# Exercise: Macintosh Software Components

## Introduction

Use this exercise to check your understanding of the basic components of the Macintosh software.

## Part A

Here is a list of the three levels of Macintosh software. Below it is a list of statements. In the space before each statement, write the letter corresponding to the software level that is described by the statement. You may use the letters more than once.

- A. Application
- B. User Interface Toolbox
- C. Operating System

- B 1. Provides the menus, windows, dialog boxes, and standard resources to software programs used on the Macintosh.
- C 2. Provides the interface to the computer hardware.
- A 3. Is a software program that users work with—such as, word processor or graphics programs.
- C 4. Performs data input and output tasks.
- A 5. Is the only level of software that users work with directly.
- C 6. Performs memory management tasks.

**Continue with Part B on the next page.**

## Exercise: Macintosh Software Components

### Part B

Here is another list of Macintosh software terms followed by a list of statements. In the space provided for each statement, write the letter of the term described by the statement. You may use letters more than once.

- |                   |            |
|-------------------|------------|
| A. Resource       | E. RAM     |
| B. System file    | F. ROM     |
| C. Desk Accessory | G. Manager |
| D. Device Driver  |            |

- D 1. Controls the exchange of information between an application and peripheral devices such as printers.
- F 2. Is memory that stores User Interface Toolbox routines and Managers permanently.
- G 3. Is a set of routines grouped by function. (For example, one of these sets up and manages menus.)
- E 4. Is memory that stores the System file, device drivers and other resources temporarily.
- C 5. Is a mini-application that can be run from within applications.
- A 6. Is a chunk of data used by Macintosh applications and system software.
- P 7. Contains the standard resources, like fonts, that are shared by all applications, the Toolbox, and the Operating System.
- R 8. Stores most of the Toolbox and Operating System routines.

Compare your answers to those provided on the following page.

Compare your answers to those provided below.

---

## Exercise: Macintosh Software Components (Answers)

### Part A

1. B. User Interface Toolbox
2. C. Operating System
3. A. Applications
4. C. Operating System
5. A. Applications
6. C. Operating System

### Part B

1. D. Device Driver
2. F. ROM
3. G. Manager
4. E. RAM
5. C. Desk Accessory
6. A. Resource
7. B. System File
8. F. ROM

If you missed more than two of these items, review the section *Introduction to Macintosh Software*.

Otherwise—

Continue with the next section - Making Copies of Disks

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# Making Copies of Disks

## Overview

As a Macintosh user and technician, you will find that you want to copy disks for different reasons at different times. You should always make backup copies of application disks and any disk that contains essential information (for example, the *Macintosh System Tools* Disk ). Use the backup copies as your normal working copies. If a working copy is damaged in any way, you still have the master disk and can make another copy.

In this section, first you will learn how to prepare diskettes for use. Then, you will learn how to make a copy of a disk by making a backup copy of the Macintosh System Tools disk.

Like the other exercises in this module, the directions assume that you are using a Macintosh SE. The procedure for making disk copies, however, is the same across all Macintosh computers.

## What You Will Need

You will need to provide the following materials for this exercise:

- a Macintosh SE, set up with keyboard and mouse;
- the *Macintosh System Tools* disk
- one new two-sided disk (that has not yet been initialized)

## Initializing 3.5-Inch Disks

Before the Macintosh can get information from or save information onto disks, the disks need to be initialized in a format the computer understands. Any time you insert a new, uninitialized disk or a disk the computer can not read (because it is damaged or it is been initialized for a different kind of computer), a message appears asking you whether you want to initialize the disk for the computer.

Initializing erases anything that may be on the disk and formats it to receive and store data. Formatting creates a grid of tracks and sectors on the disk, as shown in Figure 26, so information can be stored in an orderly fashion and retrieved efficiently.

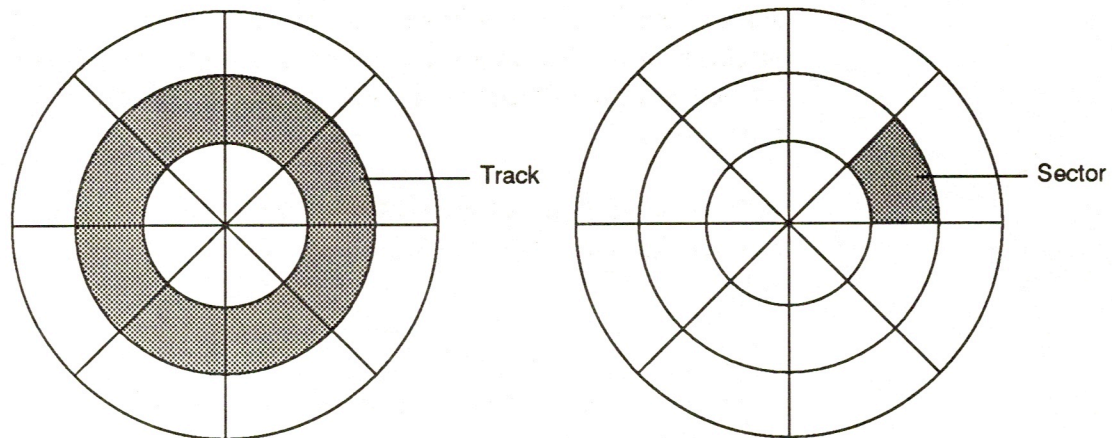


Figure 26. Tracks/sectors on a formatted disk

Follow the steps below to initialize a disk. You will use the initialized disk in the next exercise. (You will learn how to initialize the internal hard disk later in this module.)

### Initialize a disk

Normally, the labels on 3.5-inch diskettes indicate whether they are one-sided (400K disks), two-sided 800K disks, or two-sided high density (1.44MB) disks. The style and format of the label varies by manufacturer, and some provide no label.

This exercise assumes you are working with an 800K or 1.44MB diskette although the process is similar regardless of the type of disk.

Initialize a double-sided disk now by following these steps.

1. Boot the system from the *Macintosh System Tools* disk.

### With Two Disk Drives

For systems with two floppy disk drives:

2. Insert the new disk in the upper disk drive.

### With One Disk Drive

For systems with an internal hard disk.

- Eject the System Tools disk by selecting its icon and then choosing Eject from the File menu.

A dimmed icon of the disk will remain on the screen. The Macintosh will remember the information it needs about the ejected disk as long as its dimmed icon is visible on the screen. If the system needs the disk, a dialog box will appear asking you to reinsert it.

If you eject a disk by dragging it to the Trash, no dimmed icon remains, which means that the Finder has forgotten that the disk was inserted.

- Insert the new disk in the disk drive.

### The Initialization Dialog Boxes

When you insert the new disk in the drive, a dialog box appears, as shown in Figure 27.

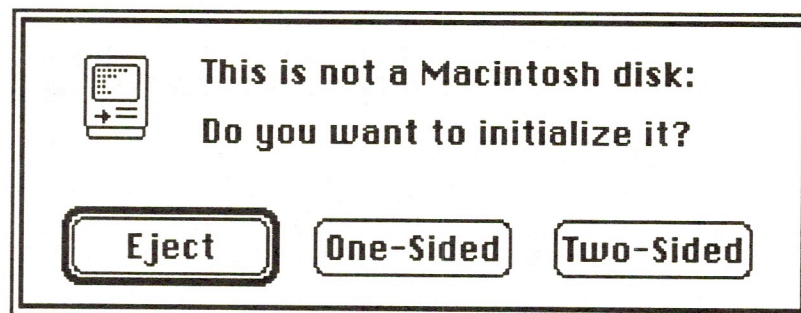


Figure 27. Dialog box for initializing a diskette

3. In the dialog box, click on Two-sided.

A dialog box, as shown in Figure 28, will appear to warn you that initializing the disk will erase everything on it.

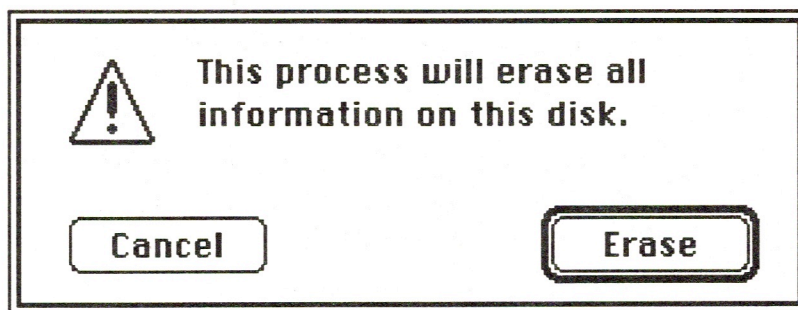


Figure 28. Dialog box warning you that initialization erases everything

4. Click Erase to confirm that you want to proceed.

Another dialog box, as shown in Figure 29, will appear requesting a name for the disk.

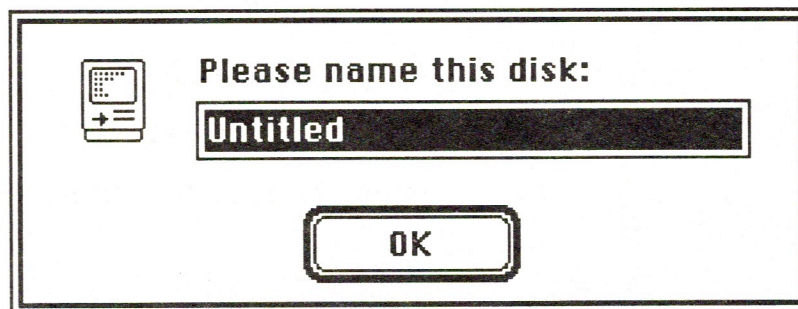


Figure 29. Dialog box requesting name for the initialized disk

5. Type a name for the disk and click OK.

To avoid confusion, give disks different names.

When the initialization process is complete, the dialog box disappears. Notice that the name you entered appears below the icon that represents the new disk. You can eject the new disk by dragging its icon to the trash, or you can leave it in the disk drive for current use. For now, leave the disk in the drive for use during the next part of this activity.

## One-Sided Versus Two-Sided

In general, you should initialize single-sided (400K) disks one-sided, and double-sided (800K/1.44MB) disks two-sided. The two-sided format installs the hierarchical file system. Disks that are initialized one-sided don't accommodate the hierarchical file system.

Even though a two-sided disk can have data on both sides, you always insert it in the same way, metal end first, label side up. The disk drive is able to get information from both sides of the disk.

Once you have initialized a disk with the two-sided format, you cannot use it in a 400K disk drive because the 400K disk drive can read only disks that are formatted on one side. If you try to insert a disk with the two-sided format into a 400K disk drive, the system will ask if you want to initialize the disk, and clicking Initialize will erase everything on the disk.

## Making Copies of Disks

In this exercise, you will make an exact copy of the Macintosh System Tools disk. This will be your backup copy.

**Note:** *You should always have a complete backup copy of the most current System Tools disk.*

The System Tools disk will be the **source disk**, the disk you want to copy. The disk that you just initialized will be the **destination disk**, the disk you will copy to.

The copying process differs depending on the drive configuration you are using.

### Making a Disk Copy on a Two-Drive System

Here are the steps for copying an entire disk when using a system with two disk drives.

1. Write-protect the source disk as shown in Figure 30.
2. If your system is turned off, boot it from the *Macintosh System Tools* disk.

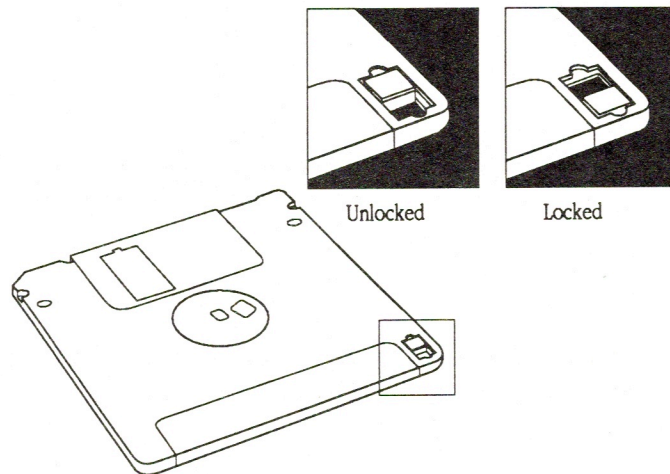


Figure 30. Write-protect source disk

The System Tools disk (the source disk) should be in the lower disk drive.

3. Insert the new disk (the destination disk) in the upper disk drive.
4. Drag the source disk icon to the destination disk icon, as shown in Figure 31.

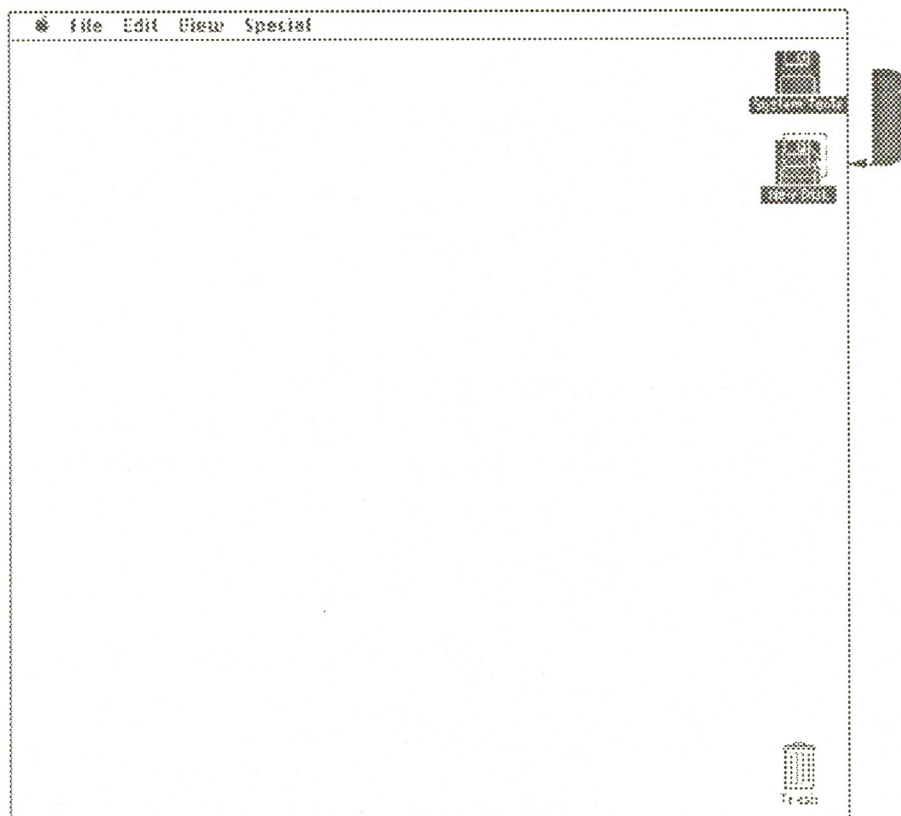


Figure 31. Dragging a disk icon to make a backup copy

A dialog box will appear, asking you to confirm that you want to replace the existing contents of the destination disk with the contents of the source disk.

5. If erasing the existing content is acceptable, click OK. Otherwise eject the disk and insert another one that is either new or can be erased.

The copying process will begin. The Macintosh erases everything on the destination disk and replaces it with the contents of the source disk.

6. When the copying is done, rename the new disk *System Tools Backup*.
7. Eject the backup disk by dragging it to the Trash.

### **Making a Disk Copy with a Hard Disk System**

To make a copy of a 3.5-inch disk when you are working on a system with an internal hard disk, you need to boot the system from the disk that you want to copy. So to make a backup copy of the System Tools disk, proceed as follows:

1. Write-protect the source disk.
2. If the system is off, insert the System Tools disk in the drive and turn on the power.

The desktop will appear.

3. Eject the System Tools disk by choosing Eject from the File menu. A dimmed icon of the disk icon will remain on the screen.
4. Insert the new disk and initialize it, if necessary.
5. Drag the source disk icon (the System Tools icon) to the destination disk icon (the new disk).

A dialog box will appear asking you to confirm that you want to erase the contents of the destination disk.

6. Click OK.

The system will eject the destination disk, and a dialog box will appear asking you to re-insert the source disk (the System Tools disk). You will see messages telling you to exchange one disk for the other, as needed, until the copy is complete.

7. Rename the new disk if appropriate.
8. Eject the copy by dragging its icon to the Trash.

That's the end of this exercise.

If you plan to continue immediately with the next section, you may leave the system on. Otherwise you can shut down the system (choose Shut Down from the Special menu

---

# Exploring the System Folder

## Overview

In the "Introduction to Macintosh Software" section of this module, you learned that when you boot a Macintosh system, it starts up by loading into RAM the System file and other resources and applications in the System Folder. This System folder data is needed to boot and run the Macintosh.

In this exercise, you will learn how to identify the contents and functions of the System Folder. This information will prove critical when you try to isolate software problems.

Like the other exercises in this module, the directions assume that you are using a Macintosh SE for this module, but the information provided in this section applies to all Macintosh computers

## What You Need

For this exercise, you will need to provide:

- a Macintosh SE, set up with keyboard and mouse
- a backup copy of a current *Macintosh System Tools* Disk

## Boot the System Tools Disk

1. Boot the system from the *Macintosh System Tools* disk.

The Macintosh desktop should appear on your screen. Remember that once you see the desktop, you are already working with an application, called the Finder. You will learn more about the Finder in a few minutes.

2. Open the System Tools icon. Either double-click on the icon or click on it once and choose Open from the File menu.

The System Tools directory window should open displaying the contents of the System Tools disk, as shown in Figure 32.

**Note:** Your window may differ slightly, depending the version of system software you use.

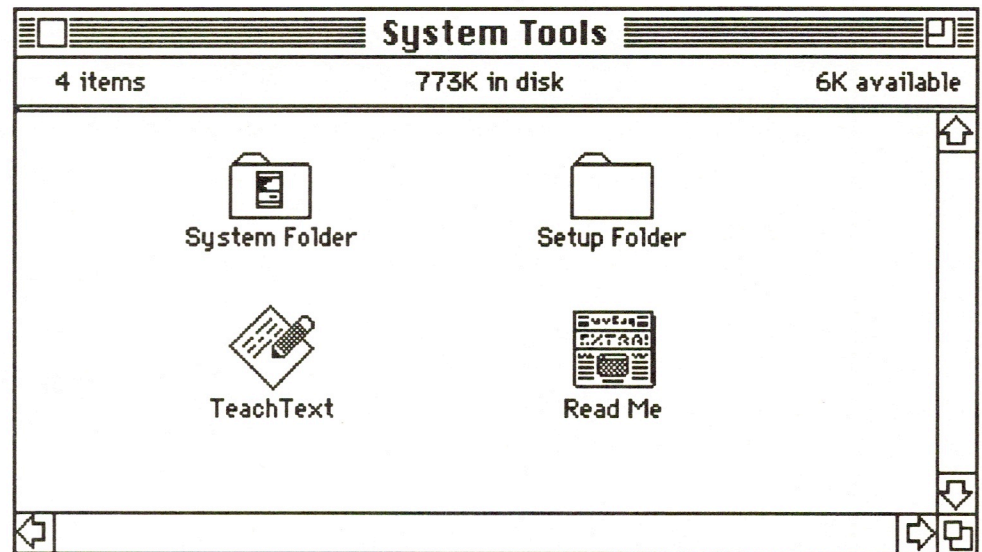


Figure 32. The System Tools directory window

### System Tools Contents

The System Tools disk contains two folders, one application, and one document:

- The System Folder holds information the Macintosh SE needs for normal operations.
- The Setup Folder contains special utility programs.
- The "Read Me" document contains information about the current release of the system software.
- TeachText is an application that you would use to open the "Read Me" document.

### The System Folder

The System Folder stores resources, files, and applications that the Macintosh uses to boot and run. This folder must be on all startup disks. The system software contained in the System Folder is universal: with a few exceptions, the same files are used for all Macintosh computers.

To begin exploring the System Folder:

3. Open the System Folder.

Your screen should display the contents of the System Folder, similar to the files shown in Figure 33.

**Note:** *The contents of your System Folder may differ slightly.*

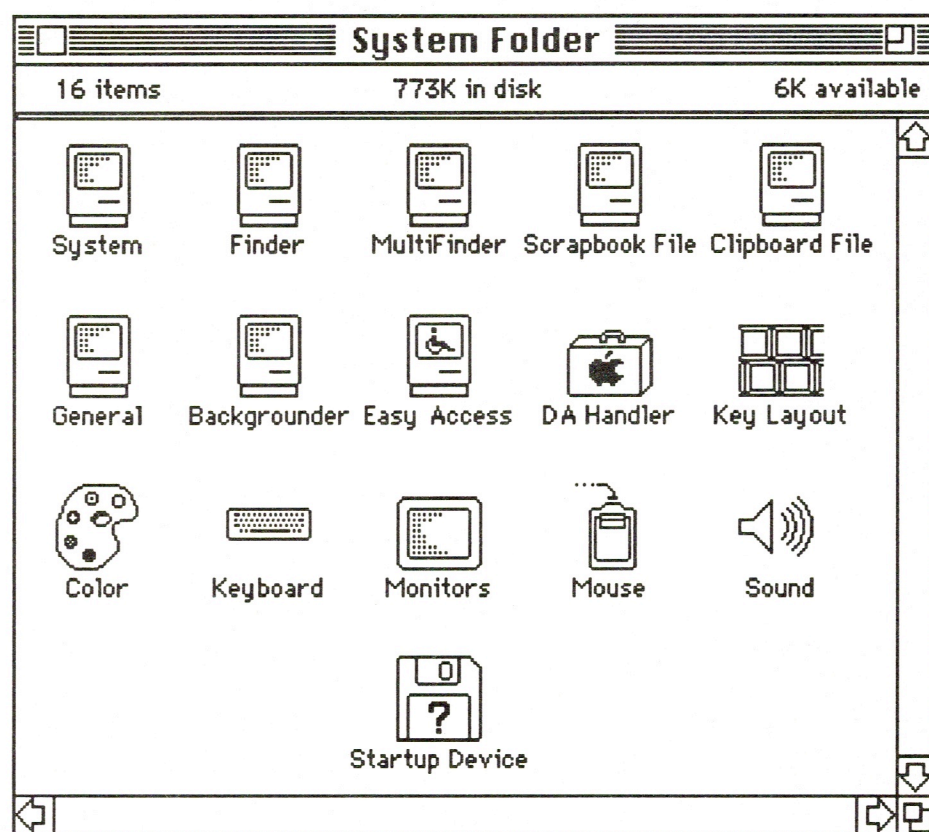


Figure 33. Contents of the System Folder

## Contents of the System Folder

You cannot open the files in the System Folder because most of them are resource files, not applications. Their use is restricted to the system, but you can remove or copy them, and you can add files to the System Folder. The exact contents of a System Folder depend on the Macintosh model and other equipment being used with the Macintosh. In general, the System Folder contains:

- the System file
- the Finder file
- Printer Resources
- Control Panel Device Resources
- miscellaneous files

The following is a description of files that are typically in the Macintosh SE System Folder. Remember, most of these files are common to all Macintosh systems.

### System File



The System file is a collection of resources (chunks of data) that are shared by all applications and by the Operating System, such as fonts and desk accessories. **Every Macintosh startup disk requires this file to start up and run the Macintosh.**

### Finder



The Finder is the application that presents and maintains the Macintosh desktop. The Finder keeps track of what files belong in which folders and where they appear on the desktop. **Every Macintosh startup disk requires this file to start up and and run the Macintosh.**

Ordinarily, the operating system designates the Finder as the startup application, that is, the application that takes control when the system is first started. When you launch an application, you automatically quit the Finder application. When you quit another application, you automatically return to (launch) the Finder. It is like a "home base" for operating the computer.

### MultiFinder



With version 6.0 and newer versions, a special Finder option is available—**MultiFinder**. MultiFinder, which requires additional system memory, allows multiple applications to be open simultaneously on the Macintosh desktop.

Note this significant difference between Finder and MultiFinder: whereas the Finder does *not* remain present when other applications are open, MultiFinder stays open while you are running other applications.

### Printer Drivers

The System Folder contains printer drivers, which are one type of resource driver. Printer drivers (sometimes called printer resources) provide the interface to specific printers, such as the ImageWriter II or the LaserWriter.

On Macintosh computers, you indicate your choice of printers with a desk accessory called the Chooser. When you select a printer with the Chooser, the system draws upon the resources in these files. **A system must, therefore, have the resource files corresponding to the printers to be used with the system.** The next four icons are examples of printer drivers:

#### ImageWriter



This is the printer driver file for the ImageWriter printers.

#### AppleTalk ImageWriter



This printer driver allows the use of an ImageWriter II printer connected to an AppleTalk network.

#### LaserWriter



This is the printer driver for the LaserWriter printers.

#### Laser Prep



This file works with the LaserWriter printer driver to provide Postscript, the language the LaserWriter uses to print text and graphics. Both the Laser Prep and the LaserWriter files are required to print to a LaserWriter.

### Control Panel Device Resources (CDEVs)

The System Folder also contains files that provide the resources required by the Control Panel. The Control Panel is a desk accessory that allows users to set system features, such as date and time. When you work with the Control Panel, the system draws upon data and instructions provided in these Control Panel Device Resource files (abbreviated as 'CDEV' files), as shown in Figure 34.

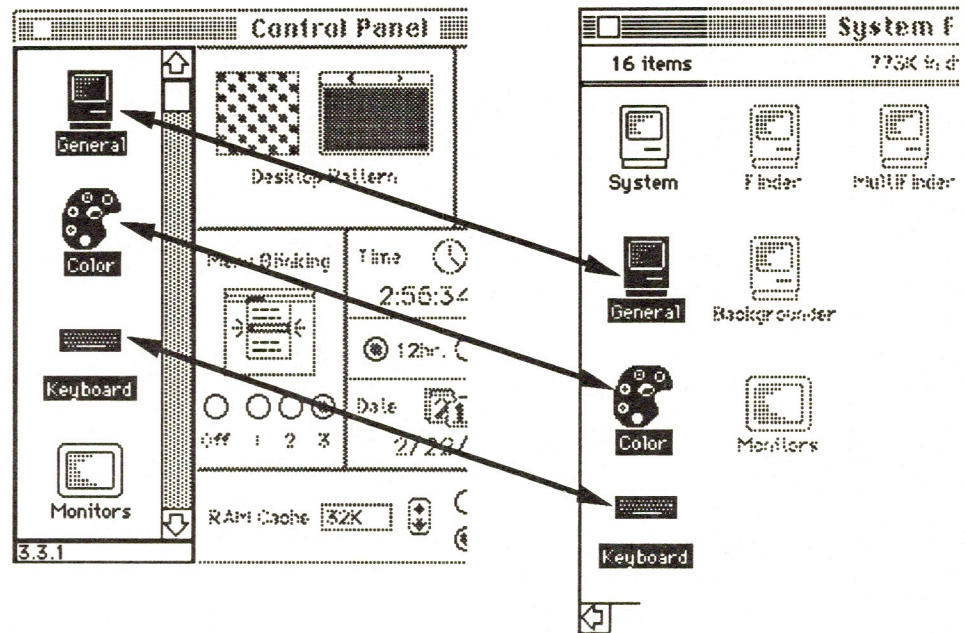


Figure 34. Control Panel draws upon CDEV resources in the System Folder

The specific CDEV files included with each Macintosh system depends on configuration requirements and user preferences. The following six icons are CDEV files

#### General



This CDEV supports the selection of optional features on the Control Panel, such as setting sound volume and desktop pattern. When the Control Panel is first opened, all the features shown are set to defaults and are controlled by this file.

#### Startup Device



This CDEV supports the selection of the startup device if more than one are connected to the system. You select the preferred device on the Control Panel.

### Mouse



This CDEV supports the selection of mouse options, such as tracking speed and double-click speed. You select these options on the Control Panel.

### Sound



This CDEV stores sound information, such as volume and type of sound, that has been selected through the Control Panel.

### Keyboard



This CDEV supports the selection of the keyboard options, such as key delay and key repeat rates, on the Control Panel.

### Miscellaneous Files

The System Folder usually contains a number of miscellaneous files, such as the following four files.

### Easy Access



This file supports the two features that Macintosh provides for disabled people: Mouse Keys, a substitute for using the mouse; and Sticky Keys, a way to input complex key sequences more easily.

### Scrapbook



This file stores graphics and text for the Scrapbook desk accessory. The Scrapbook retains information even after the system is shut down.

### Clipboard



The Clipboard file holds what the user last cut or copied on the desktop or in another application. The Clipboard loses its information when the system is shut down.

### Key Layout



This file is used in conjunction with the Key Caps desk accessory. This file stores the Key Caps desk accessory keyboard layout information.

4. Close the System folder.

Either turn off the system now by selecting Shut Down from the Special menu, or—

Continue with the next section—Exercise: The System Folder

## Exercise: The System Folder

Use this exercise to check your understanding of the contents of the Macintosh System Folder. Answer the items as indicated.

### Directions

1. Here is a list of files in the System Folder. Following the list is a list of descriptive statements. For each statement, indicate the file described by writing the letter corresponding to the file in the space provided.

- |                   |                |
|-------------------|----------------|
| A. System File    | F. Mouse       |
| B. Finder         | G. Easy Access |
| C. General        | H. Scrapbook   |
| D. ImageWriter    | I. Clipboard   |
| E. Startup Device | J. Keyboard    |

- E 1) Supports the selection of the startup device if more than one are connected to the system.
- J 2) Holds what the user last cut or copied on the desktop or in another application.
- A 3) Contains resources that are shared by all applications and by the Operating System, such as fonts and desk accessories.
- J 4) Supports the selection of the keyboard options, such as key delay and key repeat rates.
- F 5) Supports the selection of mouse options, such as tracking speed and double-click speed.
- B 6) Presents and maintains the desktop.
- G 7) Supports the desk accessory that provides disabled people with special features.
- C 8) Supports selection of miscellaneous optional features such as setting sound volume.
- H 9) Stores graphics and text for the Scrapbook desk accessory.
- D 10) Provides the interface for ImageWriter printers.

---

## Exercise: The System Folder

2. What is the Finder? Check the correct answer

- ☐ A. A CDEV
- ☒ B. A system application
- ☐ C. A device driver
- ☐ D. A desk accessory

3. The significant difference between Finder and MultiFinder is that MultiFinder...  
(Check the correct completion for this statement.)

- ☒ A. Stays open while other applications are open.
- ☐ B. Launches applications.
- ☐ C. Is available on the Control Panel.
- ☐ D. Requires considerably less memory.

4. Which of the following files, located in the System Folder, are CDEV files? Check all of the correct answers.

- |   |   |
|---|---|
| <input type="checkbox"/> A. ImageWriter file        | <input type="checkbox"/> E. Scrapbook                 |
| <input checked="" type="checkbox"/> B. General file | <input checked="" type="checkbox"/> F. Startup Device |
| <input checked="" type="checkbox"/> C. Mouse        | <input type="checkbox"/> G. Clipboard                 |
| <input checked="" type="checkbox"/> D. Keyboard     | <input type="checkbox"/> H. Finder                    |

---

## Exercise: The System Folder

**Compare your answers to those provided on the next page.**

---

## Exercise: The System Folder (Answers)

1.    1) E        6) B  
      2) I        7) G  
      3) A        8) C  
      4) J        9) H  
      5) F       10) D

2.    B

3.    A

4.    B, C, D, F

If you missed more than one item on this exercise, review the the section entitled  
"Exploring the System Folder."

**Continue with the next section - Startup Disks.**

---

# Startup Disks

## Overview

In previous sections of this module, you have been introduced to the term *startup disk*, and you have already booted your system with a startup disk—the Macintosh System Tools disk. In this exercise, you will learn how to:

- Explain what a startup disk is
- Identify the files required on a startup disk
- Identify the scanning order that the Macintosh follows to locate a startup disk
- Identify which startup disk a system is currently using
- Explain why a system should have only one System Folder

## What a Startup Disk Is

A startup disk is any disk, hard disk or floppy diskette, that contains the System file and the Finder file which are required by a Macintosh to start up and run. The Macintosh cannot operate without the information in these files. Every time you switch on a Macintosh, it scans the available disk drives for a startup disk. If the computer cannot find the folder and the files it needs, you will see one of the icons shown in Figure 35.

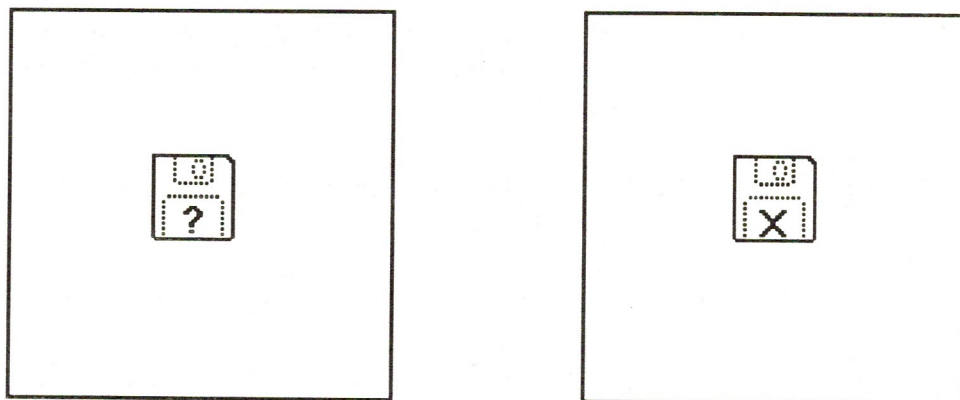


Figure 35. Icons you see when the system fails to find a startup disk

The question mark means that the Macintosh cannot find a disk at all. The X means that the Macintosh has found a disk, but it is not a startup disk.

### What the Startup Disk Must Contain

At its most basic, a startup disk is any disk that contains the System file and Finder file, which are normally kept in the System Folder. But as you learned in the section "Exploring the System Folder," other System Folder files may also be essential, depending on the type of Macintosh and the equipment involved. For example, most users will use the Control Panel and a printer, so their startup disks must contain the resource files for the Control Panel and the appropriate printer driver file(s).

In other words, a startup disk must contain the System file, the Finder file, and any other files required to run the specific Macintosh, peripheral devices, and applications that the users plan to use with the startup disk.

### What the Startup Disk Does

To help you determine which files should be stored on a startup disk, consider what the startup disk does. Besides giving the computer the information it needs to get itself started, the System Folder on the current startup disk determines:

- Which devices you can control with the Control Panel
- The fonts you have available when you use an application
- Which desk accessories appear in the Apple menu
- The contents of the Scrapbook desk accessory

### How the System Finds the Startup Disk

When starting up, the Macintosh looks for the folder that contains a System file and a Finder. Although this folder is usually called the System Folder, the folder name does not matter because the Macintosh uses the first folder it finds that contains the System file and a Finder.

In searching for such a folder, the Macintosh looks for a startup disk in the following sequence:

1. The lower internal disk drive (on Macintosh II computers, this is the drive on the right side)
2. The upper internal disk drive, if one is installed (on Macintosh II computers, this is the drive on the left)
3. Any external non-SCSI drives (either 3.5-inch drives or external hard disks)
4. Any startup device selected via the Startup Device on the Control Panel
5. Any SCSI drives (in descending order of their set priority numbers)

**Note:** *You will learn more about SCSI devices in a later module.*

When the system finds a startup disk, the system loads the information from the

System Folder on the disk into RAM. The system then draws upon this RAM-based information to start up the Finder application. The system continues to draw upon the RAM-based resources and routines for normal operation.

### Identifying the Current Startup Disk

You can tell which disk is the current startup disk by looking at the desktop—the icon for the current startup disk always appears first in the upper-right corner of the desktop. Figure 36 illustrates the desktop on a system that was booted from the System Tools disk.

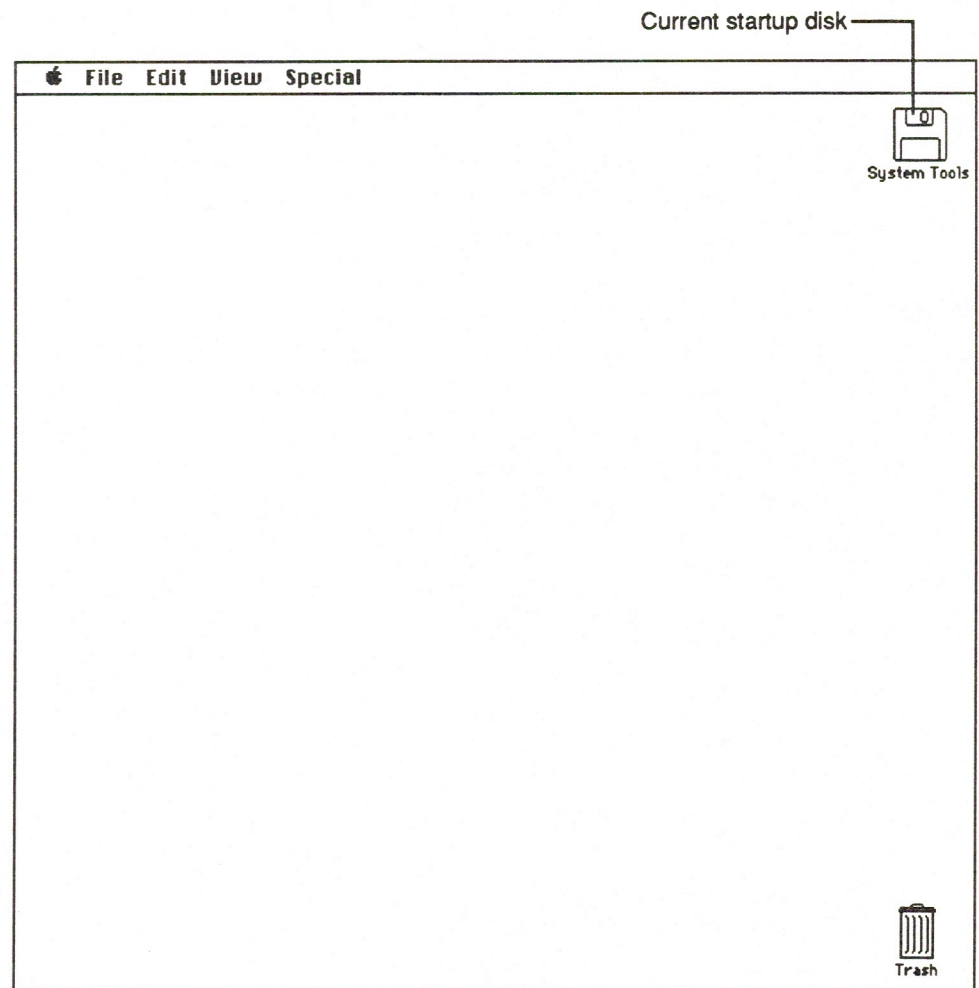


Figure 36. The current startup disk icon

### **One System Folder Per System**

With a hard disk, a common error is to install (often accidentally) multiple System Folders. One way this can happen is when a user copies an application disk onto a hard disk. Because an application disk may also be a startup disk (containing a System Folder), copying the entire disk may also copy the extra System Folder.

When a hard disk has multiple System Folders on it, the Macintosh has no way of knowing which one you want it to use. In effect, the computer takes its pick. When that happens, users may wonder what happened to the special fonts or desk accessories they installed. (They are in the System file in the System Folder the Macintosh did not use at startup.) The Control Panel may not have all the features or settings users have grown accustomed to. (They are also in the "other" System Folder.) There is never any reason to have more than one System Folder on a startup disk; it adds nothing but complications.

If you are not sure whether you have more than one System Folder on a startup disk, use the Find File desk accessory to conduct a search.

### **Hard Disk versus Floppy Startup Disks**

Files required for startup can take up a lot of space on a disk. For example, on a Macintosh II that has a color monitor, MultiFinder, a LaserWriter printer, background printing, and extra fonts and desk accessories, the System Folder can take up more than 1 megabyte of space. Obviously, you cannot fit that System Folder onto a floppy startup disk.

A hard disk provides more than enough space for a big System Folder. You can keep a Setup Folder, applications, and documents on the same disk. You can install fonts and desk accessories in the System file with relative freedom.

A system without a hard disk does not allow such options. Even with two disk drives, you need to use space wisely on a floppy startup disk so you can use the disk for more than one purpose. For example, you may want the startup disk to contain an application in addition to the System Folder.

### **Creating and Customizing Startup Disks**

Later in this module, you will learn how to create startup disks and how to customize them so to meet your system needs. You will also learn how to update your startup disks.

**Continue with the next section - Preparing the Macintosh Internal Hard Disk.**

---

# Preparing the Macintosh Internal Hard Disk

## Overview

If you prepare a Macintosh computer for a customer, you may have to configure an internal hard disk. Configuring an internal hard disk involves two tasks:

- Initialize the hard disk
- Make the hard disk a startup disk by installing the system software

This section will guide you through the steps to perform these two tasks. Like other exercises in this module, the directions assume that you are using a Macintosh SE for the module. The procedure is basically the same regardless of the type of Macintosh computer.

If you have been doing this module with an SE that has an internal hard disk, you should follow the directions to configure the hard disk. If your computer doesn't have an internal hard disk, you should read through this section to become familiar with these procedures.

## What You Need

If you're going to prepare a hard disk during this exercise, you need the following:

- a Macintosh SE with an internal hard disk, with the keyboard and mouse attached
- a backup copy of the *Macintosh System Tools* disk

## Initializing the Internal Hard Disk

Similar to 3.5-inch diskettes, hard disks must be initialized before they can be used with the Macintosh. Initialization formats a hard disk with tracks and sectors and installs a device driver, a file that tells the computer how to work with the hard disk. Remember that initialization erases anything that may be on the disk.

**Important:** *Someone else may already have prepared the internal hard disk on the system you are working with. If so, you probably won't want to initialize the hard disk again. Reinitializing a disk wipes out any information already stored on it.*

*To see if your hard disk has already been prepared, switch the Macintosh SE on with a Macintosh System Tools disk (or any startup disk) in the disk drive. If the hard disk is already initialized, its icon will show up under the startup disk on the Macintosh SE desktop. If all you see is the startup diskette on the screen, the hard disk has not been prepared and you can go ahead and initialize it.*

Follow these steps to initialize the hard disk:

### How to Initialize the Hard Disk

1. Boot your system from the *Macintosh System Tools* disk.

If your computer is already on, but you have another disk in the drive, choose Shut Down from the Special menu and remove the ejected disk. Then, insert the System Tools disk and click the Restart button on the screen.

After a few seconds, you should see the *System Tools* disk icon on the Macintosh SE desktop.

2. Open the System Tools disk icon.

You should see the System Tools disk window, as shown in Figure 37.

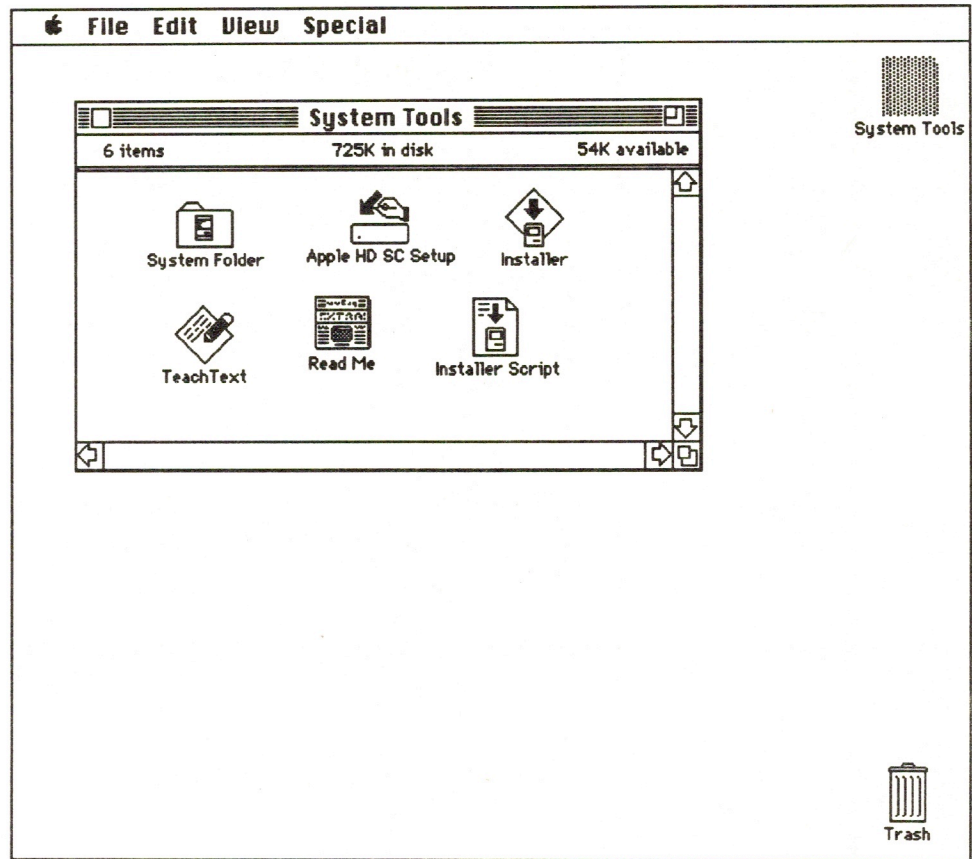


Figure 37. System Tools disk directory window

Among some other icons, you will see the icon for the Apple HD SC Setup. This is the utility you use to initialize a SCSI hard disk.

3. Double-click the Apple HD SC Setup icon.

The Apple HD SC Setup dialog box appears, as shown in Figure 39.

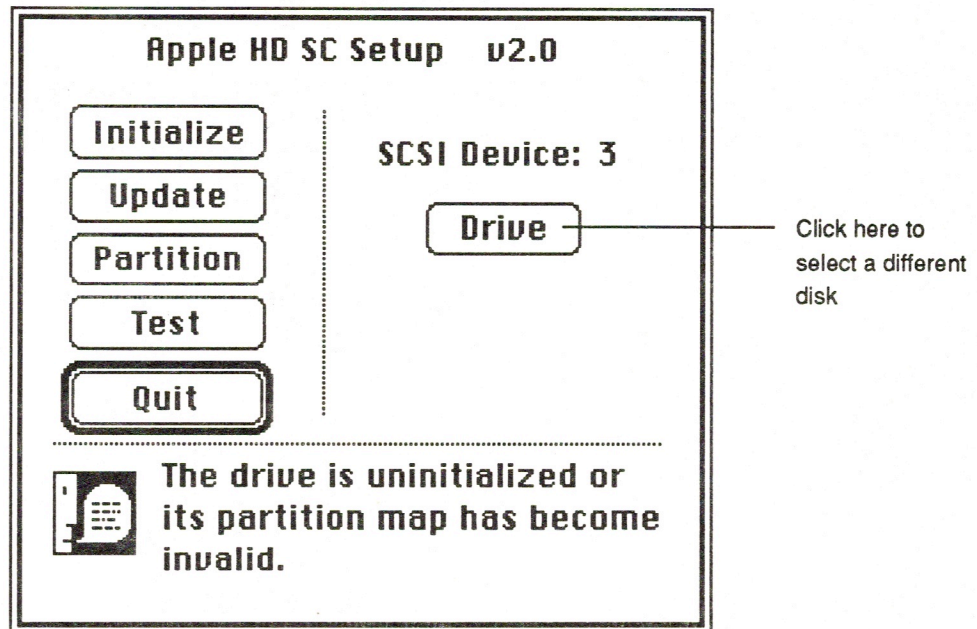


Figure 39. Apple HD SC Setup dialog box

4. If necessary, click the Drive button to select the disk you will initialize.

If you have only one hard disk installed with the system, its SCSI Device number (zero) should automatically appear in the dialog box. But if other hard disks are connected to the system, you need to make sure you initialize SCSI device 0. If it is not the correct number, click **Drive** until the number 0 appears. (You will learn more about this and the other buttons in a later module of this course.)

5. Click Initialize.

Another dialog box appears, giving you a chance to change your mind; it warns you that the initialization process erases the whole disk.

6. Click Init to start the process.

Various messages appear on the screen that explain what is going on during the process. Initialization takes from two to five minutes for a 20MB hard disk drive.

A message tells you when the hard disk has been successfully initialized. If you see a message that the hard disk failed to initialize properly, try again. If you are still unable to initialize the hard disk, get another computer and try again.

After the hard disk is initialized, you are asked to name the disk. Disk names can contain up to 27 characters. You can use any character you can type on the keyboard except a colon (:). The name cannot begin with a period (.). If the hard disk has been previously initialized, you will not be asked to name it.

7. Type a name and then click OK.

8. Click Quit.

You return to the Finder, which now includes the hard disk icon on the right side of the desktop with the name you've given it, as shown in Figure 40.

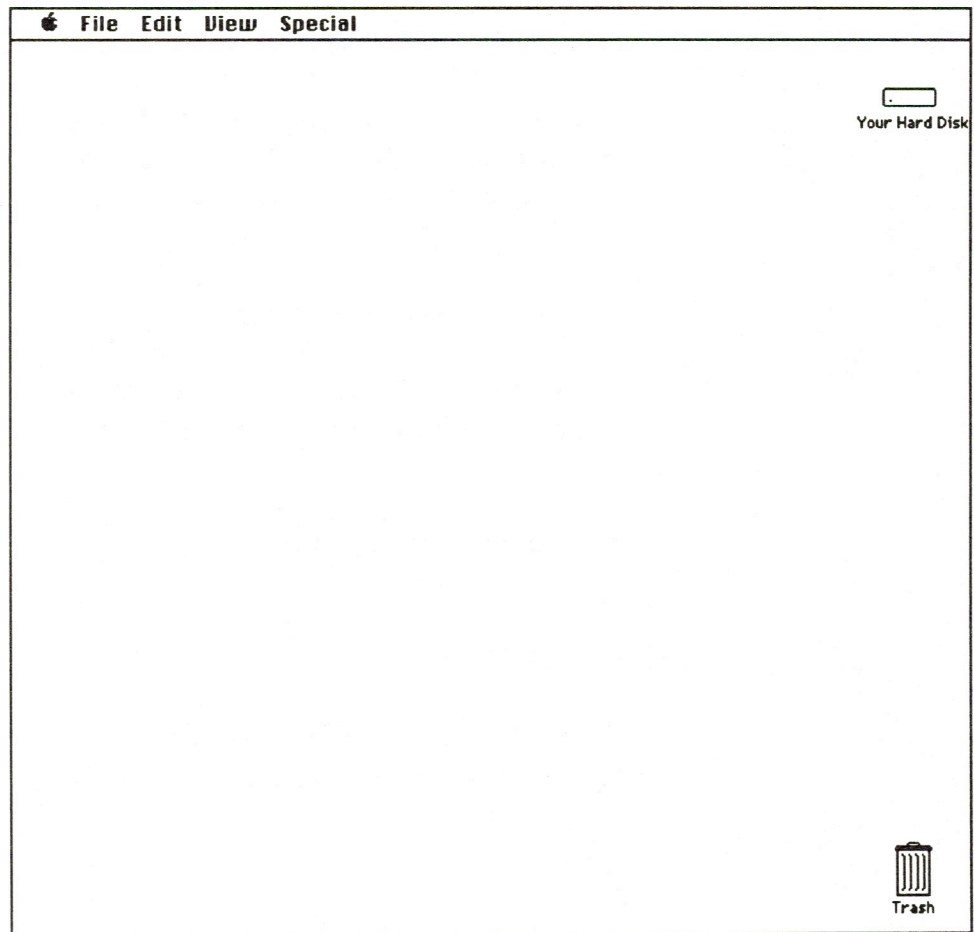


Figure 40. Desktop showing the hard disk icon.

### Making the Hard Disk a Startup Disk

At the beginning of this section, when you booted the system from the System Tools disk, the system located the System folder on that disk in the lower internal disk drive. The system loaded the instructions from the System Folder into RAM. The system then used those RAM-based instructions to start up the Finder application.

Even though you have initialized the internal hard disk, the system is still working from the instructions loaded into RAM from the System Tools disk.

You are now ready to load the system software onto the hard disk, thus making it a startup disk. Then, you will be able to boot the system from the hard disk.

### The Installer

To load system software onto a disk, you use the **Installer**, a general-purpose program designed to install, update, and remove Macintosh software. Installer does the following to a startup disk:

- Creates and updates startup disks with resources
- Installs a new Control Panel, Chooser, Find File, Key Caps, and Desk Accessories
- Updates the Alarm Clock, Calculator, and Scrapbook, if they are present on the disk
- Updates any Apple printer resources on the disk
- Adds or updates these fonts:

Times	Courier
Helvetica	Geneva
Chicago	Monaco

### Loading System Software onto the Internal Hard Disk

To install the system software onto the internal hard disk, follow the steps below.

1. If your system is not already on, boot it from the *Macintosh System Tools* disk.
2. Open the System Tools disk icon.
3. Launch the Installer by double-clicking its icon. See Figure 41.

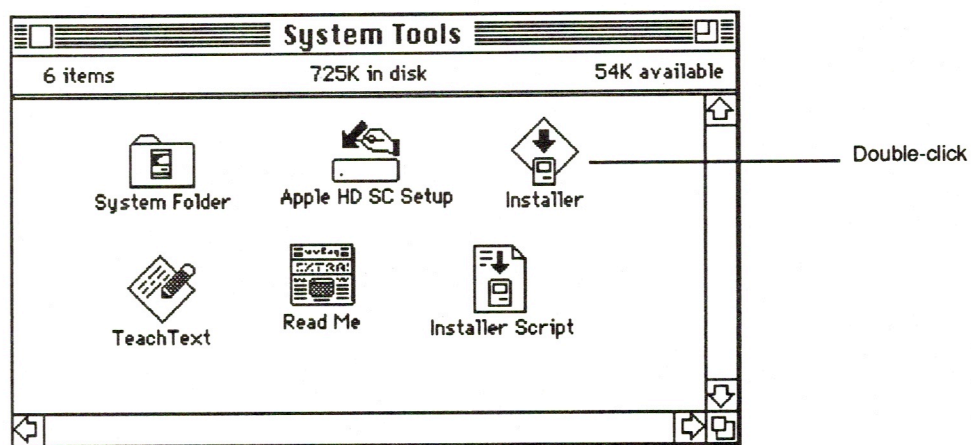


Figure 41. Launching the Installer

A "Welcome" box describes how the Installer works and briefly lists your options.

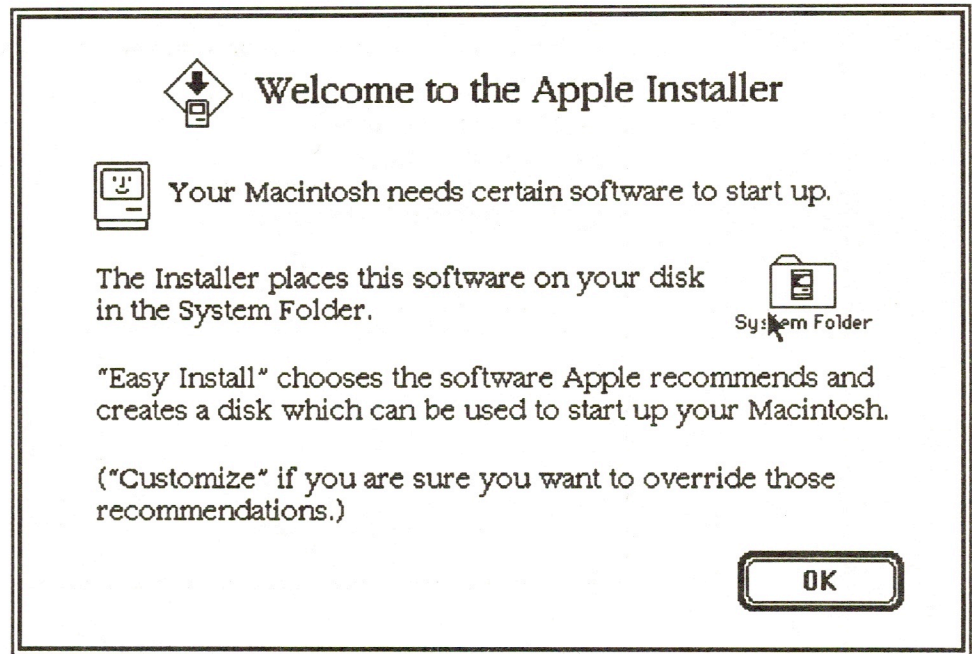


Figure 42. "Welcome to the Installer" dialog box

4. Click OK.

The Installer window opens as shown in Figure 43.

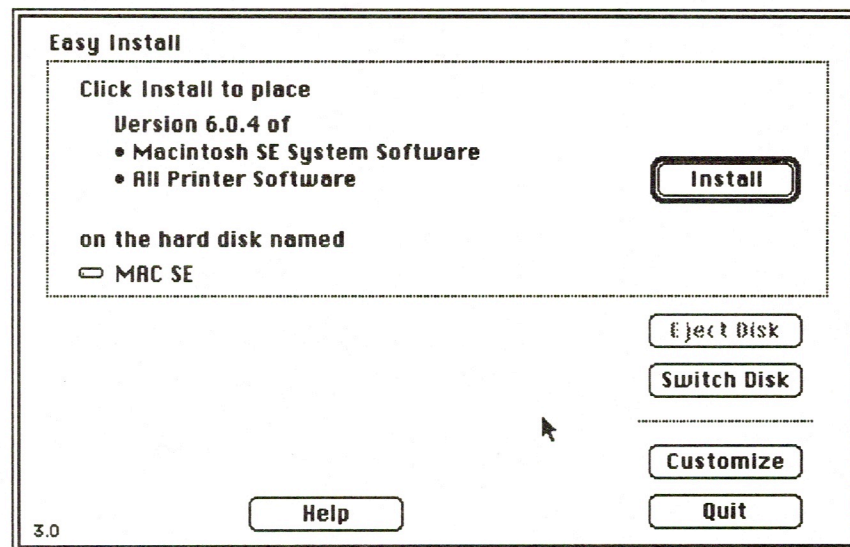


Figure 43. The Installers Easy Install window

The Installer gives you two options: Easy Install and Customize. Easy Install is automatically selected when you open the Installer. Easy Install will place the system software files needed to run your system (in this case the Macintosh SE), and all Apple printer driver files onto the hard disk.

5. Click Customize.

The Customize window opens as shown in Figure 44.

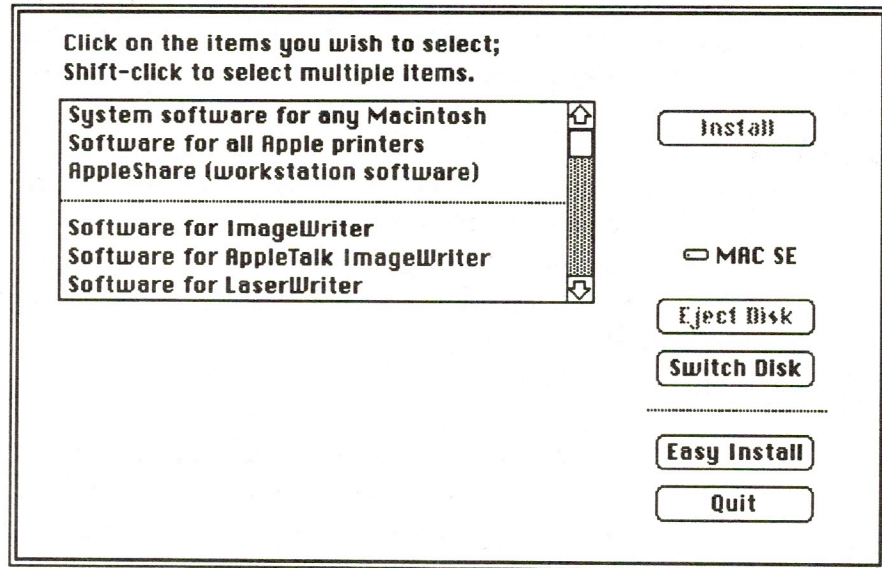


Figure 44. The Installer Customize window

Customize lets you choose which system software files you want to install. For this exercise, you will choose easy install.

6. Click Easy Install.

You are back to the Easy Install window.

7. Click Install.

The Installer will load all of the system software files onto the hard disk. The installer asks you to insert the other Macintosh System Software disks as required.

8. When the installation is complete, click Quit.
9. At the desktop choose Shut Down from the Special menu and remove the System Tools disk.
10. Click the Restart button on the screen.

The Macintosh SE restarts itself, this time using the hard disk as the startup disk. In a moment, you should see the desktop with the hard disk icon on it. Now you can use the hard disk to store your applications and documents.

### Working with a Hard Disk

You work with a hard disk and a diskette in the same way: opening icons, copying applications and documents, and organizing information in folders are identical. The only real difference is that you cannot eject a hard disk.

### Bootling the System

Remember—to boot the system from the hard disk, you must remove any startup disks you have in other disk drives. If, on the other hand, you want to boot the system from a startup diskette, just insert the diskette in a disk drive and power on the system. The system will find that startup diskette first and boot from it rather than from the hard disk.

**Caution:** *Never shut off the computer while the hard disk in-use light is blinking. The in-use light blinks when the hard disk is moving information around. Shutting the computer off while the hard disk is working can make the hard disk lose information. And sometimes it can damage the disk directory, making it necessary for you to reinitialize the hard disk (and in the process lose all the information on the disk).*

**Continue with the next section - Making Startup Diskettes**

---

# Making Startup Diskettes

## Overview

Previous sections of this module explained what startup disks are and how to make the internal hard disk a startup disk. In this section, you will learn how to make 3.5-inch diskettes startup disks and how to customize and update startup disks.

Users with a hard disk system will normally use the hard disk as their startup disk, users with a two-floppy drive system need to boot the system from 3.5-inch diskettes that are startup disks, for example, the *Macintosh System Tools* disk.

Many application disks come prepared as startup disks. If they do not, users can usually make them startup disks by adding the necessary files. Like the other exercises of this module, the directions assume that you are using a Macintosh SE for this module. The procedures are the same across all Macintosh computers.

## What You Will Need

You will need to provide the following materials for this exercise:

- a Macintosh SE with keyboard and mouse; if the SE has an internal hard disk, the disk should be initialized and set up as a startup disk
- the *Macintosh System Tools* disk
- one blank two-sided disk

## How Do You Create a 3.5-Inch Startup Diskette?

As was explained in the section *Startup Disks*, to serve as a startup disk, a 3.5-inch diskette must contain all the System File, the Finder, and other files required by the particular system to start up and run.

The first step in creating a startup disk is to install the required system software. You can do this in either of the following ways:

- Use the **Installer**.
- Copy files by dragging the appropriate files onto the destination disk (referred to as a "Finder copy").

## Creating a Startup Disk with Installer

The Installer is a program designed to install, update, and remove Macintosh software. (This is the same Installer program that was used to make the internal hard disk a startup disk in the section *Preparing the Macintosh Internal Hard Disk*.)

Follow the procedure below to use the Installer to create a 3.5-inch startup diskette.

1. Boot your system from the *Macintosh System Tools* disk.
2. If the new disk has not been initialized, initialize it.
3. Open the System Tools disk icon.
4. Launch the Installer.
5. Click OK at the Welcome window.
6. If you are using a one floppy drive system click Switch Disk and then click Eject Disk.
7. Insert the new disk (in the upper drive of a two-drive system).

The diskette name will appear in the window.

8. Click Install. (See Figure 45.) Insert system software diskettes as requested.

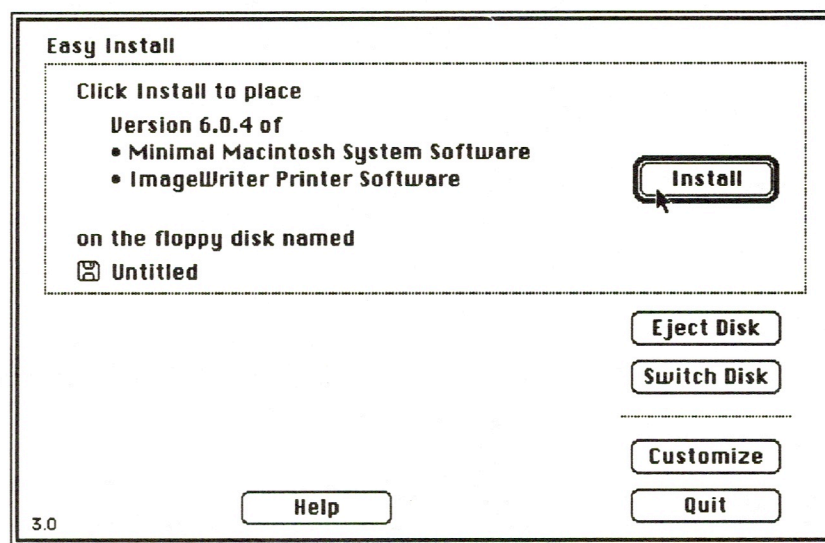


Figure 45 The Easy Install dialog box

9. When the installation is complete, click Quit.
10. At the desktop, choose Shut Down from the Special menu and remove the System Tools disk.
11. Insert your newly created startup disk and click the restart button on the screen.

The Macintosh SE will start up from the startup diskette.

### Creating a Finder Copy

You can also create a startup disk from the Finder by copying the contents of System Tools disk (the source) to the new disk (the destination). To make a Finder copy, you would follow the procedure presented earlier for making a backup copy of a disk.

**Caution:** *Use the Finder Copy method only for creating a new startup disk. Do not use this method for updating a startup disk because the disk copy process erases all information on the destination disk. When updating startup disks you do not want to erase everything.*

### Updating a Startup Disk

From time to time, you will receive new versions of the Macintosh system software. To update a startup disk, use the Installer. The steps for this are the same as for creating a startup disk, except that the Installer will update the existing files rather than replace them. This means that the DAs and fonts on your existing disk will be retained. This is true of hard disk startup disks and 3.5-inch startup disks.

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# Customizing Startup Disks

## Why Customize Startup Disks?

By using the Installer or by making a Finder copy of the System Tools disk, you have placed the basic system software on the startup disk. Now you can customize the diskette so that it contains exactly what you need for your specific uses. Remember that when you work with a Macintosh, the system can use only those fonts, desk accessories (DAs), and driver resources provided by the current startup disk.

**Note:** *The information and procedures presented in this section apply to customizing startup hard disks also.*

Before customizing a startup disk, answer these questions:

1. What applications will you (or the user) use with the startup disk you are creating?
2. What devices (for example, printers or detached monitors) will be used with those applications?
3. What fonts and DAs will be used with those applications?
4. Are any additional special files needed (for example, special scrapbook files)?

The answers to questions 2 through 4 indicate to you which fonts, DAs, and additional special files (for example, printer driver files) you must have on the startup diskette. Once you know what you need on a specific startup disk, customizing it involves two tasks:

- installing additional resource files, fonts, and DAs that are needed
- removing those that aren't needed

Removing files is not always necessary, but you can free up disk space by doing so. System files, fonts, and DAs take up a lot of space on startup disks. Removing any that are not needed can free up considerable space.

Before you learn the procedures for customizing a startup disk, here is more explanation about fonts and DAs.

**Font Requirements**

The fonts listed below are representative of the fonts contained in the System File on a standard Macintosh system disk. Depending on the System version number, the disk may have additional fonts. The fonts marked by asterisks are required by the system. Fonts that are not required may be removed from the System File, and, of course, other fonts may be added.

- \*Chicago 12 (used for menu bar, dialog boxes, etc.)
- Courier 10
- Courier 12
- \*Geneva 9 (used for desktop file names)
- \*Geneva 12
- Helvetica 10
- Helvetica 12
- \*Monaco 9
- Times 10
- Times 12

### Desk Accessories Requirements

Desk accessories are small applications and utilities that are available from the Apple menu regardless of which application you're using.

The most frequently used DAs are the Chooser and the Control Panel. As with fonts, DAs can be installed or removed from the System file, but you must have at least one desk accessory installed, and no more than 15. Generally, the Chooser and Control Panel are required or desired by users. Other DAs are included by user preference.

Users often acquire additional DAs and fonts from third-party vendors.

### Adding and Removing Fonts and DAs

Fonts and DAs currently available to the system are contained in the System file. Other fonts and DAs are stored in special font files and DA files, as shown in Figure 46.



Figure 46. Icons representing font and desk accessory files

To add fonts or DAs to the System file or to remove them, you use a special application, provided on the Utilities disk, called the **Font/DA Mover**. It allows you to copy fonts and DAs from the "suitcase" files where they are stored to the System file, to remove them from the System file, or to copy them from one file to another. (You cannot just open the System file and drag fonts and DAs back and forth.)

### Using the Font/DA Mover

Follow the steps below to copy or remove a font or DA from a startup disk. If your system has two disk drives, customize the startup disk you created earlier in this section. If your system has an internal hard disk, customize it instead of the 800K startup diskette. You will use the Font/DA Mover in the same way regardless of whether you are working with a floppy diskette or a hard disk.

**Note:** *If you are using System software version 7.0 or higher, fonts and desk accessories are added to the system folder simply by dragging them into the system folder on your startup disk.*

1. Boot the system from the startup disk.

**With an internal hard disk**—Boot from the hard disk. Then insert the Utilities 2 disk in the disk drive.

**With two floppy drives**—Boot from the startup disk you just created. Then insert the Utilities disk in the upper drive.

2. Open the Utilities 2 disk icon.

You will see the Utilities directory disk window. If you see the icon for the Font/DA Mover application, open it. At the Utilities level, you may instead see an icon for a Font/DA Mover Folder. In that case, open the folder and then open the Font/DA Mover icon, as shown in Figure 47.

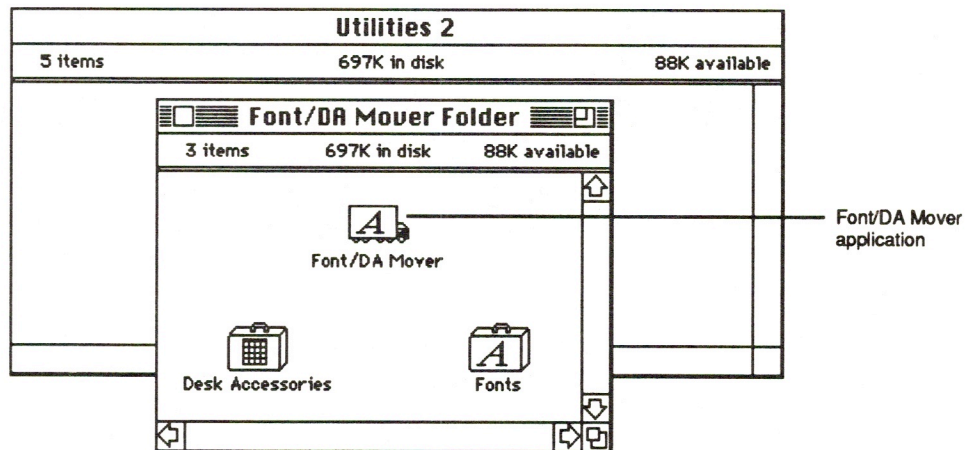


Figure 47. The Utilities disk directory window

3. Open the Font/DA Mover icon.

You will see the Font/DA Mover dialog box, as shown in Figure 48.

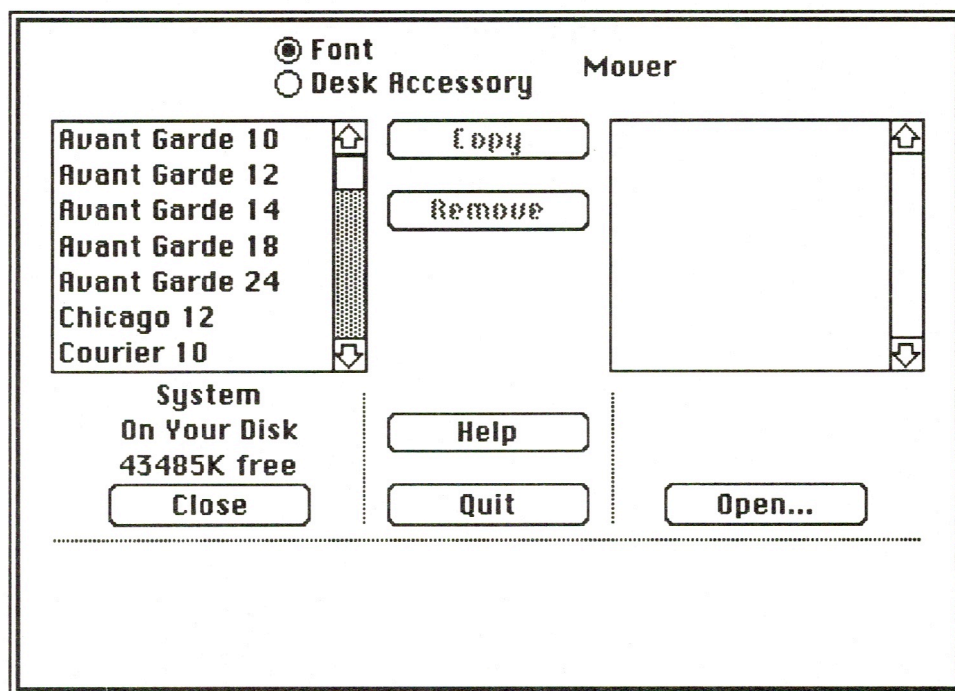


Figure 48. A typical Font/DA Mover window

Note that the Font button at the top of the Font/DA Mover screen is selected as the default and a list of fonts appears automatically in the left window.

The program uses the same procedure and presents the same windows to install and remove both fonts and DAs. In this exercise, you will be given directions to copy or remove a font from the System File. (If you want to work with DAs instead, click the Desk Accessory button. The process is identical; the only difference that you will see is a list of DAs in the windows instead of fonts.)

When you open the Font/DA Mover, you are opening a window into the System file. The name of the disk and file to be customized appears in the dialog box on the left above the Close button, as shown in Figure 48. A list of the fonts or desk accessories already installed in the System file appears in the left window above the file name. Depending on your selection, the list on the left always displays either the fonts or DAs **in the system file on the current startup disk.**

If the name of the disk and file you want to customize is not shown correctly above the Close button on the left, you should double-click the Close button.

A directory dialog box will appear. Click on the drive button until you see the name of the disk that you want to customize. Then, locate the System file on the desired drive and open it. You will automatically return to the Font/DA Mover. The fonts currently available in the selected System file will be displayed in the left window.

4. Now click the Open button on the right side.

You will see a directory dialog box of the Font/DA Mover folder on the Utility disk, as shown in Figure 49.

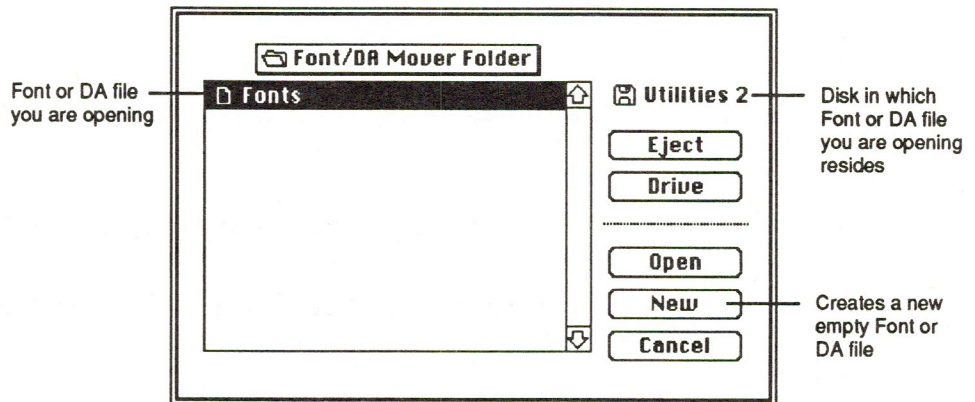


Figure 49. Directory dialog box for locating system, font, or desk accessory files

The file that appears in the directory will be either the Font or DA file, depending on whether you selected the Font or DA button when you opened the Font/DA Mover.

5. Click Open or double-click the highlighted file in the directory dialog box as shown in Figure 49 to display a list of fonts on the Utilities disk.

A list of fonts will appear in the right window.

Notice that the Open button changes to Close. The name of the disk and file also appears above the Close button.

If the file you want does not appear, follow one of the methods below to locate the desired font or DA file in another folder or on another disk.

- a) Click on the Drive button until the correct disk is displayed or click on Eject and insert the correct disk. The name of the disk you are looking at is always shown at the top right of the dialog box.
- b) Click on the Folder name to display the file directory and select the appropriate folder.

Then locate the desired file, select it, and open it to display the list of fonts or DAs in the right-hand window of the Font/DA Mover screen.

6. In the right window, select the font or DA you want to copy into the System file.
7. Click Copy to copy the selected font and DA in the direction the arrows point.

Figure 50 shows a font selected for copying into the System File.

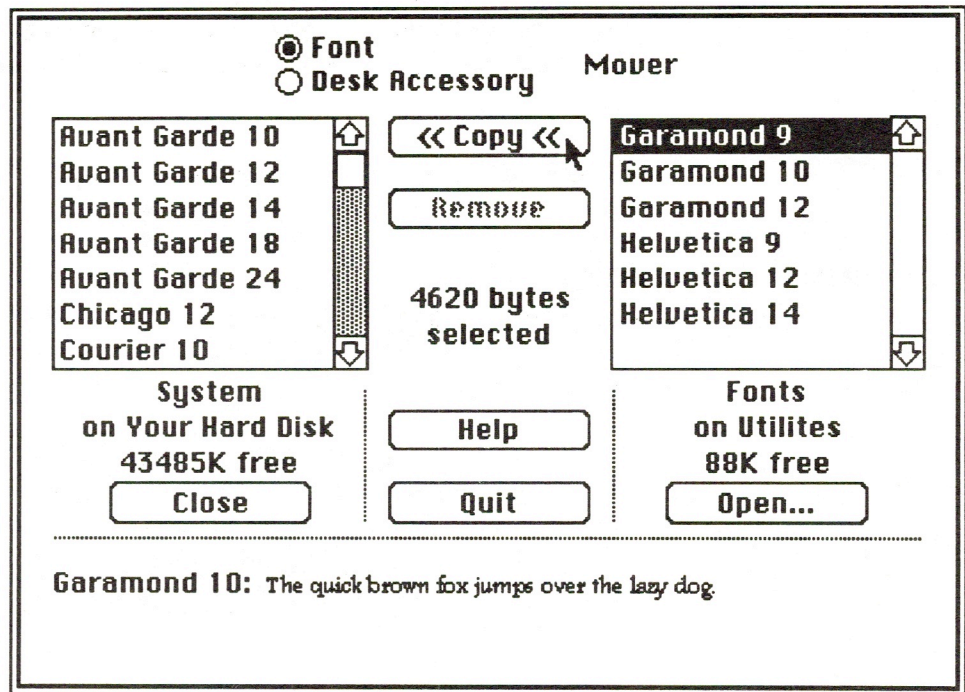


Figure 50. Copying a selected font with Font/DA Mover

If you wanted to remove a font or DA from the System file, you select the font or DA in the left window and click Remove. Remember that you cannot remove any fonts that the System needs.

When the copying or removal process is complete, you can select another font or DA to process.

8. Click Quit to leave the Font/DA Mover.

### Working With Fonts and DAs on the Desktop

On the Desktop, you can drag any font or DA files that you no longer need to the Trash, or copy or move these files between disks. **But to install them in a System File so that the system can use them, you must use the Font/DA Mover program.**

In this exercise, you opened the Font/DA Mover by opening its icon. Opening the icon for any font or DA file also opens the Font/DA Mover.

### Adding or Removing Resource Drivers

You have just learned how to use the Font/DA Mover to add fonts and DAs to the System File and to remove them from the System File. Another way you can customize startup disks is to add or remove resource driver files or other special files.

You can do this by dragging the file icons from one folder or disk to another. For example, if you want to add a LaserWriter to a system, you need to add the LaserWriter and Laser Prep printer drivers to the System Folder of the startup disk. These files are provided on the Macintosh Printing Tools disk. Insert the *Printing Tools* disk in a disk drive, open the icon, and drag the appropriate files over to the System Folder on the startup disk.

### More Practice?

If you want to free up space on a startup disk, you can remove unnecessary printer drivers (or other special files, but not DAs and fonts) by dragging them from the System Folder to the trash. You can also drag them to another System Folder on another startup disk.

Now you have learned two ways to customize startup disks: using the Font/DA Mover to add or remove fonts or DAs, and dragging resource files or other special files to and from the System Folder on a startup disk.

You might want to take time now to gain more familiarity with the Font/DA Mover by adding and removing some fonts and/or DAs.

Otherwise, shut down your system, and ...

**Continue with the next section - Configuring the Control Panel.**

---

# Configuring the Control Panel

## Overview

The Control Panel is a desk accessory that lets users personalize the computer to their own way of doing things. For example, the Control Panel provides the means to change the speaker volume, set the system real-time clock, and set the desktop background. If you set up systems for customers, you may need to configure the Control Panel for them.

In this section, you will become familiar with the Control Panel parameters and learn how to set them. The directions for this exercise assume that you are using a Macintosh SE for this module. The procedures are the same across all Macintosh computers.

**Note:** *When setting up a new system, you may also have to configure the Chooser. The Chooser is a desk accessory that lets you select devices (usually printers) connected directly to the printer port or the modem port, or devices on an AppleTalk network. You will learn how to work with the Chooser in a later module, when you connect the ImageWriter II printer to a Macintosh.*

**Note:** *The Control Panel has changed in System 7.0. System 7.0 information is covered in an optional lab module in the Macintosh Service Course.*

## What You Will Need

You will need to provide the following materials for this exercise:

- a Macintosh SE with keyboard and mouse connected; if the SE has an internal hard disk, the disk should be initialized and set up as a startup disk
- a copy of the *Macintosh System Tools* disk (if you are using a system with two drives)

## Accessing the Control Panel

To look at the Control Panel on your Macintosh:

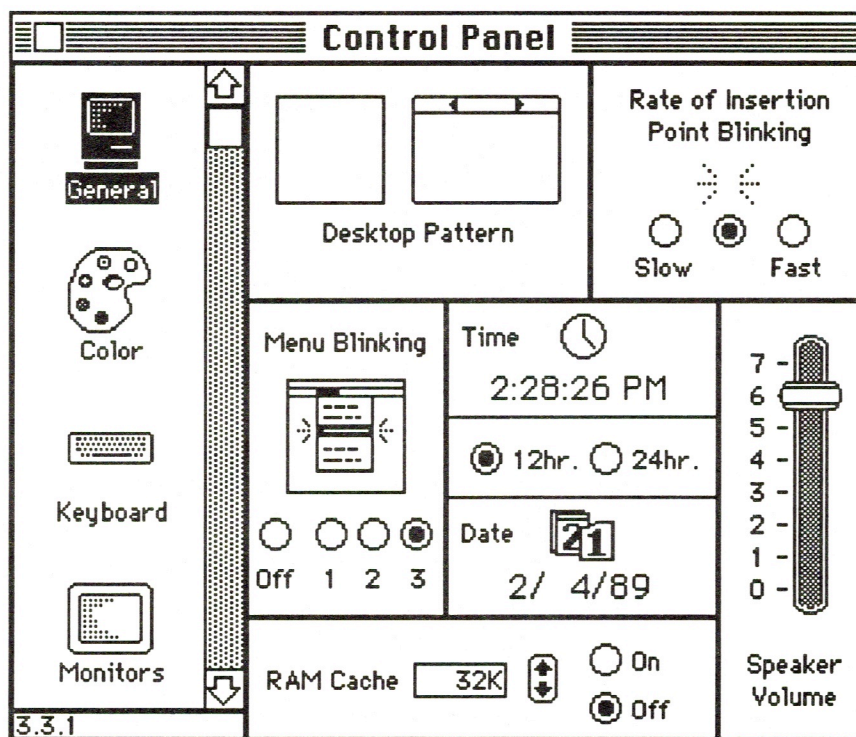
1. Boot up your system unless it's already on.

Boot from the hard disk, if you have one.

If you are using a system with two disk drives, boot from the System Tools disk.

2. Choose Control Panel from the Apple menu.

The Control Panel, shown in Figure 51, should appear on your screen.



**Figure 51. The Control Panel**

The left column is a scrollable list of icons. (You can scroll this window only if the scroll bar is shaded, indicating that there are more icons to see.) Each icon represents a part of the computer system (for example, Keyboard, Mouse). The icon General represents miscellaneous parts, as you will see later.

Selecting one of these icons brings up the display of the controls on the right side of the panel. When you open the Control Panel, the General icon is usually selected, as shown in Figure 51.

3. Try clicking on different icons to see how the right side of the Control Panel changes.

As you learned in the section Exploring the System Folder, each of these items (represented by the icons on the left) is controlled a Control Panel device resource (a CDEV) file in the System Folder.

When the Control Panel is first brought up, it scans the System folder for CDEV files. Upon finding one, it takes the file's icon and name and adds it to the scrollable icon list. Then, as you select an icon and work with the options it provides, the system draws upon the corresponding resource file in the System folder.

The following CDEV files are supplied by Apple and are listed in order of appearance. Users can acquire additional CDEVs from third-party vendors.

General	All Macintosh computers
Color card	Macintosh II only
Keyboard	All Macintosh computers
Monitors	Macintosh II only
Mouse	All Macintosh computers
Sound	Macintosh II only
Startup device	All compact and module Macintosh computers
Portable	Macintosh Portable only

### Setting the Time

You can set the Macintosh system time by following these steps (see Figure 52):

4. Click the General icon if it isn't already selected.
5. Select a time format by clicking either 12 hours or 24 hours.
6. Click on the digits (of the displayed time) you want to change. Up and down arrows will appear to the right of the displayed time.
7. Click the up or down arrow to scroll the numbers higher or lower.
8. Click on the clock above the time to activate the new setting.

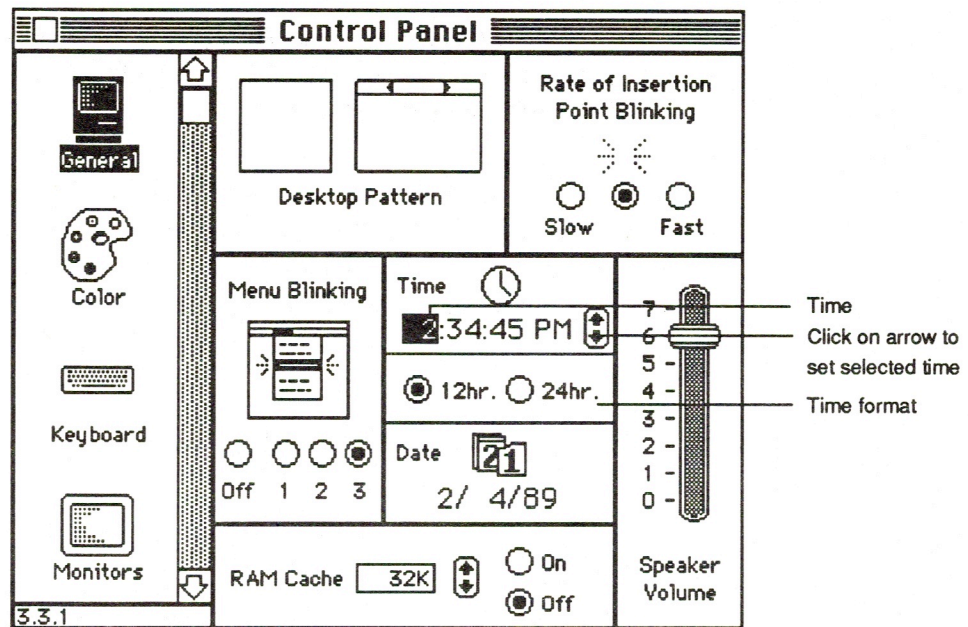


Figure 52. Setting the time on the Control Panel

### Set the Date

Set the date in the same way you set the time. Click the digits you want to change and then click the up or down arrow to scroll to the numbers you want. Click the calendar page icon to activate the date settings.

### Other Settings

The Macintosh SE Owner's Manual has complete directions on what parameters you can set with these controls and how to set them. Generally, you set the other parameters in much the same way as you just set the time and date: click on icons, buttons, digits, or arrows. To set the speaker volume slide the knob up or down the volume bar.

### Update Startup Disks with Control Panel Changes

Remember that these parameters are controlled by files in the System Folder. After making changes to the Control Panel, make sure you update each of your startup disks so that they each display the current settings on the Control Panel.

### **How Are the Times and Dates Maintained?**

Some of the Control Panel settings—for example, time and dates—need to be preserved when the Macintosh is off, so they are stored in Parameter RAM. When the system power is turned off, an internal battery provides power to the Parameter RAM, thereby saving all the settings stored in it. The settings stored in Parameter RAM aren't affected by the current startup disk.

This is the end of this exercise. You may continue to explore the Control Panel or shut down your system.

**Continue with the next section - Exercise: Using the Macintosh**

# Exercise: Using the Macintosh

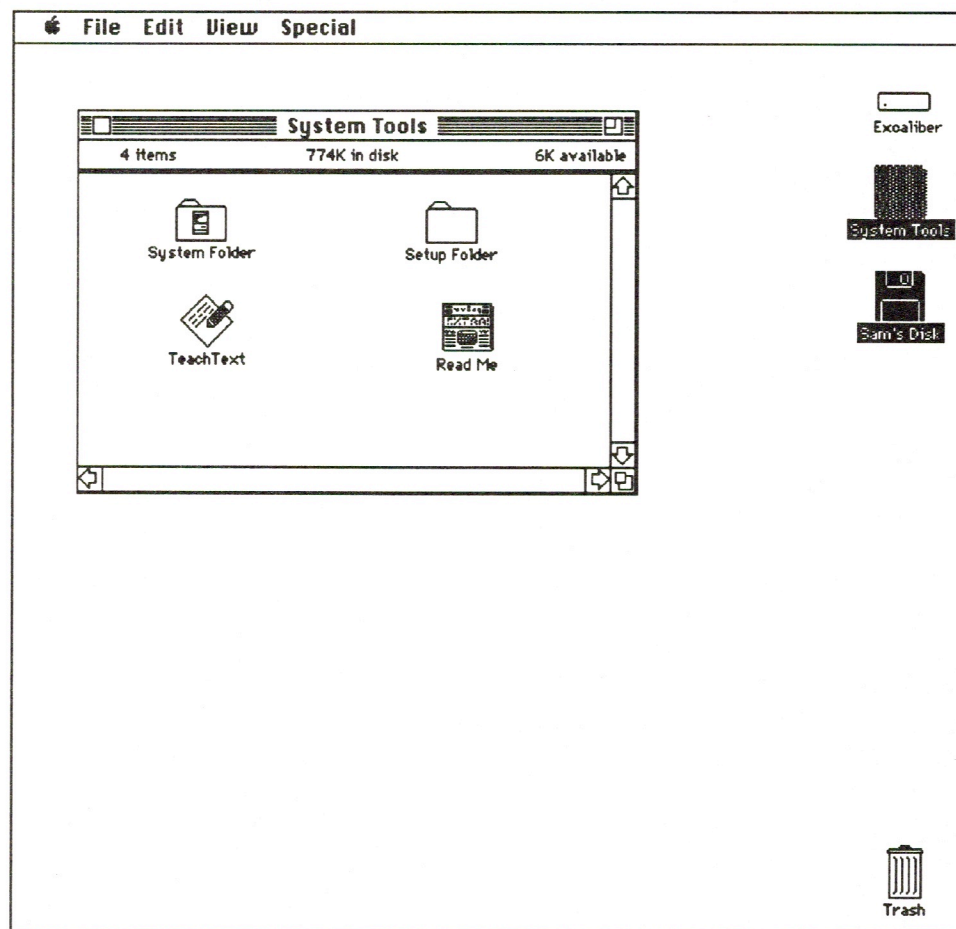
Use this exercise to check your understanding of how to use Macintosh computers. The exercise is presented in two parts.

## Part 1

The items in this part are multiple choice. For each item, circle the correct answer.

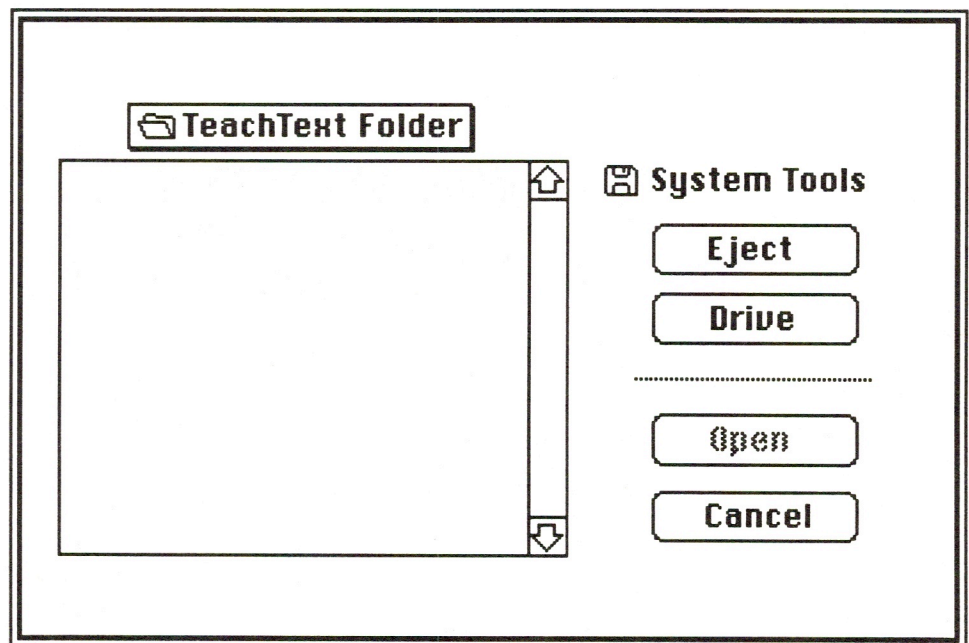
1. In the figure below, which disk is the startup disk?

- ☒ A. Excaliber
- ☐ B. System Tools
- ☐ C. Sam's Disk



## Exercise: Using the Macintosh

2. Which of the following commands place text or graphics that you have selected onto the system clipboard? Circle all correct answers.
- A. Save
  - B. Save As
  - ☒ C. Cut
  - ☒ D. Copy
  - E. Paste
  - F. Delete
3. The following figure shows the dialog box that appears when you choose Open from the File menu when you are within an application. No files are listed in the dialog box. Why?



- A. You need to click Open to see the list of files.
- B. You need to click Drive before any list of files and folders is displayed.
- C. You have to return to the Finder to see the file icons.
- ☒ D. At this level, no files can be opened with the application you are using.

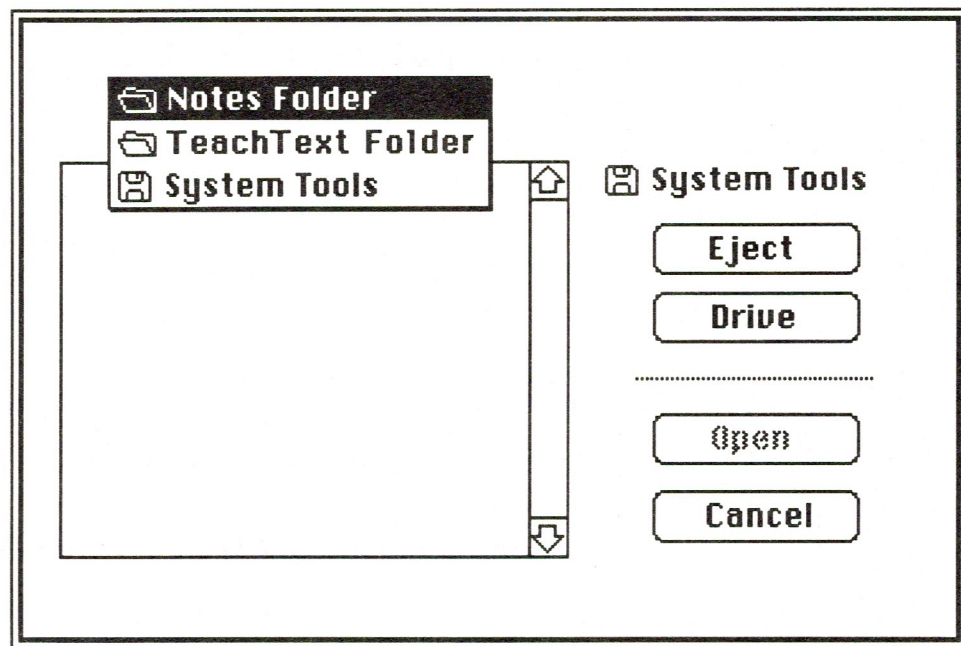
## Exercise: Using the Macintosh

4. Look at the dialog box for question 3. Assume that you want to open a file that is on another disk. What should you do to see the list of files on the other disk?
- A. Pull down the Directory title menu.
  - ☒ B. Click on Drive.
  - C. Click on Cancel to exit the program.
  - D. Click on the icon representing the disk that is currently open.

5. In the following figure, the directory title menu is pulled down.

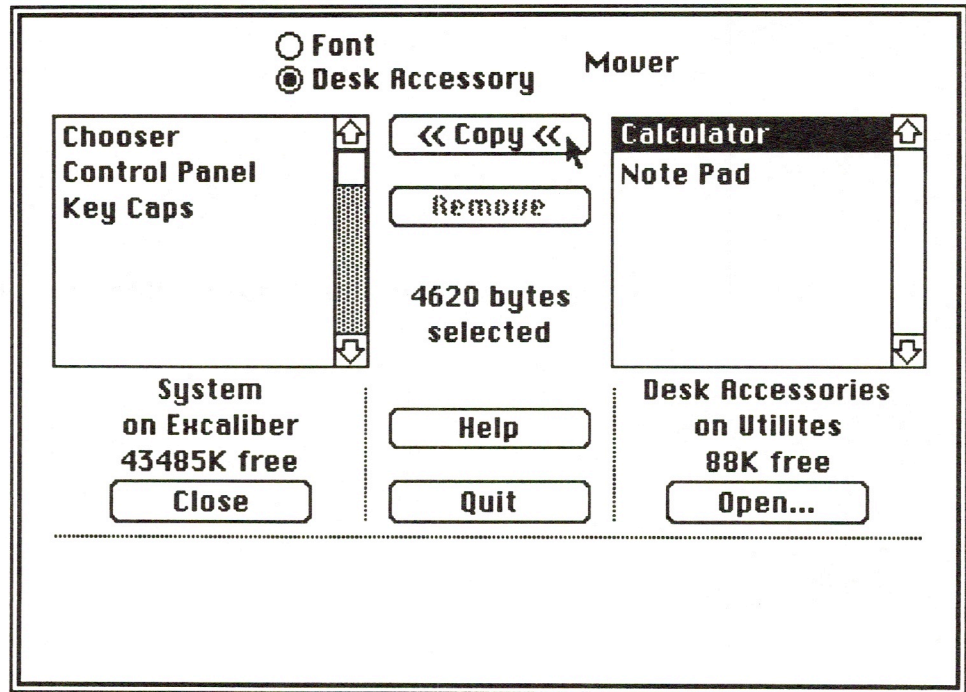
Which item is the top level of the hierarchy of files and folders?

- A. Notes Folder
- B. TeachText Folder
- ☒ C. System Tools



## Exercise: Using the Macintosh

6. The following figure shows the Font/DA Mover dialog box. What is the name of the disk that is selected for customizing?



- A. Utilities  
B. Excaliber  
C. Desk Accessory  
D. Mover
7. Which of the following can you set on the Control Panel? Check all correct answers.
- A. system time  
B. date  
C. pattern of the desktop background  
D. speaker volume  
E. display brightness  
F. printer selection  
G. preferred startup device

---

## Exercise: Using the Macintosh

8. When using System 6.0.7 or earlier, what is the maximum number of desk accessories that are allowed in the System file under normal circumstances?
- A. 9
  - B. 12
  - ☒ C. 15
  - D. there is no limit

**Compare your answers to those provided on the next page.**

---

## Exercise: Using the Macintosh (Answers)

### Part 1

Check your answers against the ones provided below.

1. A
2. C, D
3. D
4. B
5. C
6. B
7. A, B, C, D, G
8. C

**Continue with Part 2 on the next page.**

---

## Exercise: Using the Macintosh

### Part 2

Indicate if the following statements are correct or incorrect by circling TRUE or FALSE.

1. When you open a document from the desktop, the application used to create the document is automatically opened.

☒ TRUE   FALSE

2. You can create only three levels of nested folders.

TRUE   ☒ FALSE

3. Find File is a desk accessory that can help you locate files you have nested in a hierarchy of folders.

☒ TRUE   FALSE

4. When you initialize a disk, anything that was previously on the disk will be erased..

☒ TRUE   FALSE

5. To make a Finder copy of a disk, you use the Installer program.

TRUE   ☒ FALSE

6. To make a backup copy of a disk, drag the icon of the original disk (the source) to the icon of the backup (the destination) disk.

☒ TRUE   FALSE

---

## Exercise: Using the Macintosh

7. When a Macintosh SE system with two disk drives boots up, it checks the lower drive first for a startup disk.  
✓  
TRUE FALSE
8. If a Macintosh SE system has an internal hard disk, the system will always use the hard disk as the startup disk.  
✓  
TRUE FALSE
9. You can use the Installer to create and update a startup disk.  
✓  
TRUE FALSE
10. The primary reason for customizing startup disks is to remove the Finder because it has been replaced by the MultiFinder.  
✓  
TRUE FALSE
11. You can remove any of the fonts from the System File.  
✓  
TRUE FALSE

**Compare your answers to those provided on the next page.**

---

## Exercise: Using the Macintosh (Answers)

### Part 2

Check your answers against the ones provided below.

1. True - Provided the application resides on the same disk.
2. False. There is no limit to the levels you can nest files and folders.
3. True
4. True
5. False. The Installer is a program that installs, updates, and removes Macintosh software. A Finder copy is made by copying the contents of one disk to another disk.
6. True
7. True
8. False. The system searches for the startup file in a fixed sequence. The internal hard disk is the last in the sequence.
9. True
10. False. The primary reason for customizing startup disks is to maximize disk space.
11. False. You can't remove fonts that the system uses for its dialog boxes, file and folder titles, etc.

If you missed more than two items in this activity, you should become more familiar with performing basic tasks on the Macintosh. You may want to take time to review the following sections of this module:

- Startup Disks
- Preparing the Macintosh Internal Hard Disk
- Making Startup Diskettes
- Configuring the Control Panel

**Continue with the next section - Module Summary.**

---

# Module Summary

This section outlines the key points from this module.

## How the Macintosh Software Is Organized

Macintosh software falls into three levels. At the top level are **applications**. On the Macintosh, users always work at the application level.

Applications draw upon the lower levels—the **User Interface Toolbox** and the **Operating System**. In general, the Toolbox provides the standard user interface, and the Operating System provides the interface to the computer hardware.

## Other Software Concepts

**Resources** are chunks of data used by Macintosh programs. For example, every menu, font, and icon is stored as a resource.

**Managers** are sets of routines that provide specific functions. For example, the Menu Manager locates and delivers the resources needed to provide the system menus.

**Device Drivers** are programs that control the exchange of information between an application and a device.

## Where System Software Is Contained

Almost all of the Toolbox and Operating system routines are stored in the Macintosh ROM. In between major ROM revisions, updated routines and resources are provided on the System Tools disk. When the system boots up, it loads these routines into RAM for temporary use.

## Using the Macintosh SE

You learned to use the Macintosh SE when you completed the disk entitled *Your Apple Tour of the Macintosh SE*. You may want to go through parts of the tour again or to review the Summary of the Tour section of this module.

### The Desktop

The desktop is the Macintosh computer's normal working environment. On the desktop, icons represent files, folders, applications, disks, and the trash. You can organize the files, folders, and applications by moving them around just as you would on a real desk.

You can also organize files within folders and folders within other folders, thus taking advantage of the Macintosh **hierarchical file system**.

### Desk Accessories

Desk accessories (DAs) are mini-applications that are available on the desktop from the Apple menu regardless of which application you're using.

The **Chooser** is a desk accessory that allows users to select devices connected to the printer port or the modem port or devices on an AppleTalk network.

The **Control Panel** is a desk accessory that lets users personalize the computer, for example, set the system time and date.

### System Folder

The System Folder contains files of data and instructions used by the system to perform basic functions. It contains the System file, Finder, Printer Resources, Control Panel Device Resources, and other miscellaneous files such as the Clipboard.

### System File

The System file contains the resources that are shared by all the applications and by the system, such as fonts and desk accessories. The System file and the Finder application are required by the Macintosh system to start up.

### The Finder

The Finder is a system application that organizes and manages your documents and launches other applications. It's the "home base" for operating the Macintosh. The Finder provides and manages the **desktop**.

**MultiFinder** is a Finder option which allows multiple applications to be open simultaneously. Contrary to Finder, which closes when another application is opened, MultiFinder stays open while other applications are running.

### Startup Disks

A startup disk is any disk that provides the information required by the system to start up—the System file and the Finder application. Depending on the type of system and the devices attached, more files may be required on a startup disk.

**Searching for the Startup Disk**

The Macintosh searches for the folder containing a System file and a Finder in the following sequence:

1. the lower internal disk drive (or right drive)
2. the upper internal drive, if installed (or left drive)
3. any external non-SCSI drives
4. any SCSI drives

You can set the preferred startup disk using the Control Panel.

**Creating Startup Disks**

To create and update startup disks you use the Installer, a program designed to install, update, and remove Macintosh software.

**Customizing Startup Disks**

The Macintosh system has available only the fonts and DAs provided on the current startup disk. You can customize a startup disk by adding or removing fonts, DAs, and other special files.

Font/DA Mover is the program used to add or remove fonts and DAs to a System File. You can remove any font that is not required by the system. A system must have at least one desk accessory. Under normal circumstances, the system supports a maximum of 15 desk accessories.

You can add and remove other special files (for example printer drivers) by dragging their icons from one file or disk to another.

**Initializing Disks**

Before a disk (either hard disk or 3.5-inch diskette) can be used by a system, the disk must be initialized. The initialization process formats disks to receive and store information. This process erases anything that happens to be on the disk.

### Backup Disks

You should make backup disks (copies) for all important disks. To make a backup disk, copy the contents of the disk to a new disk. This is called a Finder copy because it's made by using the Finder application.

### Preparing Internal Hard Disks

Before using an internal hard disk you must initialize it, and normally you'll make it a startup disk. To initialize the hard disk, you use the Apple HD SC Setup program provided on the *Macintosh System Tools* disk. To make it a startup disk, you use the Installer program.

You have now completed this module.

**Check your skills and knowledge against the Skills Checklist for this module. When you are ready, take the Module Test.**

# Module Test

## Directions

For items 1 through 9, check the correct answer or answers. (On some of the items, more than one answer may be correct.)

1. What is a Finder copy?
  - A. A copy of a disk made with the Installer
  - ☒ B. A copy of a disk made at the desktop by dragging the icon of the source disk to the icon of the destination disk
  - C. A copy of a document made by choosing Save As under the File menu
  - D. A file that stores fonts and desk accessories that aren't being used
  
2. Which of the following must be placed on all startup disks?
  - ☒ A. the Finder
  - B. the Utilities folder
  - C. the Installer
  - ☒ D. the System file
  - E. the Font/DA Mover
  
3. Which of the following methods can you use to load required software files onto a startup disk?
  - ☒ A. Drag files from the System Folder to the new startup disk
  - ☒ B. Copy the System Tools disk
  - ☒ C. Use the Installer
  - D. Use the Control Panel
  - E. Use the Font/DA Mover
  
4. Which of the following methods should you use to update a startup disk?
  - ☒ A. Use the Installer
  - B. Use the Font/DA Mover
  - C. Use the Control Panel
  - D. Copy the new System Tools disk
  - E. Drag the new System Folder from the new System Tools disk to the startup disk

---

## Module Test

5. Which of the following can you use to select devices connected to the Printer or Modem port?
- A. the Installer
  - B. the Font/DA Mover
  - C. the Control Panel
  - ☒ D. the Chooser
  - E. the Finder
6. When using System 6.0.7 or earlier, what is the maximum number of desk accessories that are allowed in the System file under normal circumstances?
- A. 12
  - ☒ B. 15
  - C. 18
  - D. 20
  - E. unlimited
7. When you initialize a disk, what happens to it?
- ☒ A. Anything on the disk is erased
  - B. The System Folder is copied onto the disk
  - ☒ C. The disk is formatted to receive and store data
  - D. The routines on the disk are updated

---

## Module Test

8. Which of the following can you set on the Control Panel?

- A. printer selection
- ☒ B. speaker volume
- ☒ C. system time
- ☒ D. date
- E. display brightness
- ☒ F. preferred startup device

### Directions

For items 9 through 15, answer as indicated.

9. Below are a list of Macintosh software parts and a list of descriptive statements. For each statement, write the letter corresponding to the software part being described.

- |                     |   |
|---------------------|---|
| A. Application      | <input checked="" type="radio"/> Contains QuickDraw                               |
| B. Toolbox          | <input checked="" type="radio"/> Is the level users always work with              |
| C. Operating System | <input checked="" type="radio"/> Interfaces with the system hardware              |
|                     | <input checked="" type="radio"/> Provides the user interface for all applications |
|                     | <input checked="" type="radio"/> Manages memory                                   |

---

## Module Test

10. Here is a list of software terms. Below the list is another list of statements. For each statement, write the letter corresponding to the term being described.

- |                   |                  |
|-------------------|------------------|
| A. Resource       | E. Installer     |
| B. Desk Accessory | F. Device driver |
| C. System file    | G. Manager       |
| D. CDEV           | H. Finder        |

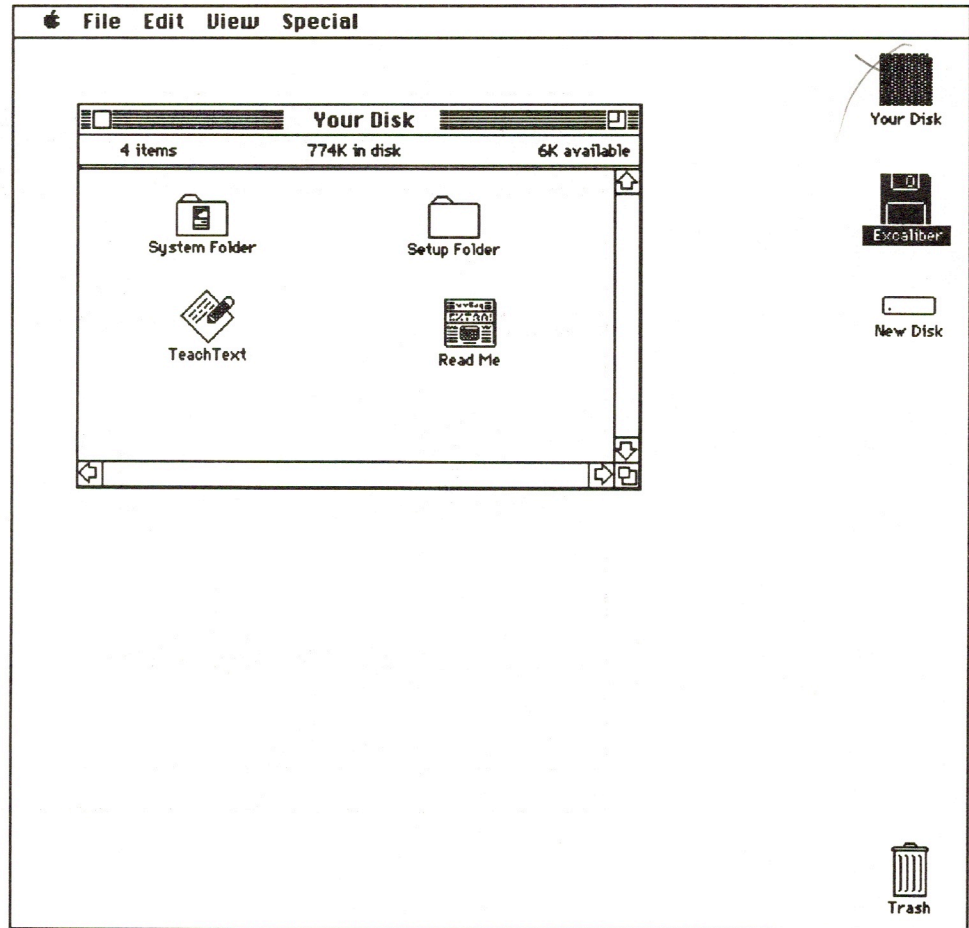
- ☒ Controls the exchange of information between an application and peripheral devices such as printers
- ☐ Is a chunk of data used by Macintosh programs
- ☐ Contains routines and resources required by the Macintosh, such as fonts and desk accessories
- ☐ Is a set of routines grouped by function
- ☐ Is a mini-application that can be run from within applications
- ☐ Is an application that creates and manages the desktop
- ☐ Provides the resources needed by the control panel
- ☐ Is a program that adds, updates, and removes Macintosh software

11. Indicate the sequence in which the Macintosh searches for the required startup information. In the blanks, write the numbers 1 through 5 to indicate the order, with 1 indicating the first place the system looks for the information.

- ☒ any SCSI drives in descending order of ID numbers
- ☐ the lower internal disk drive (right side on Macintosh II computers)
- ☐ the upper internal disk drive (left side on Macintosh II computers)
- ☐ any external non-SCSI drive
- ☐ any startup drive designated on the Control Panel

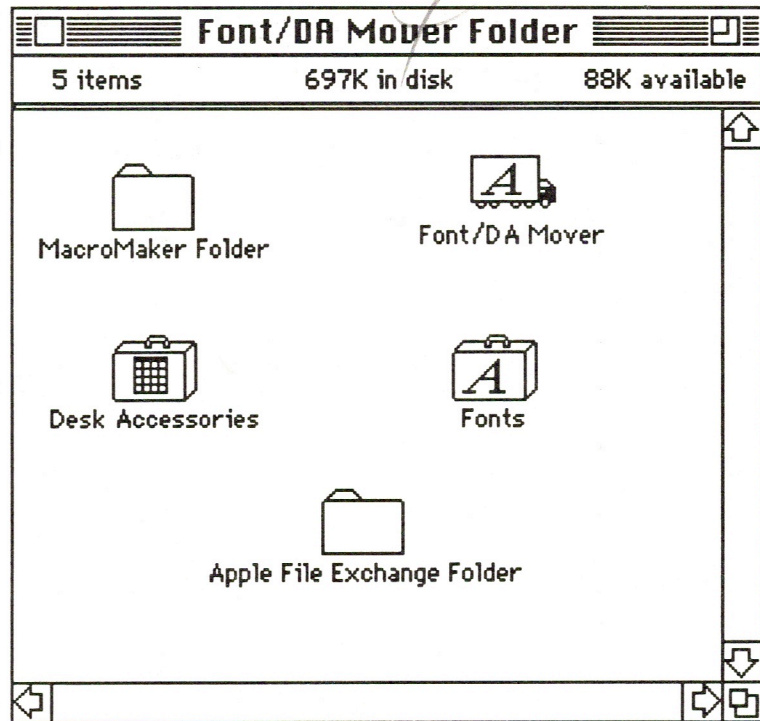
# Module Test

12. In the figure below, draw an X on the icon that represents the startup disk



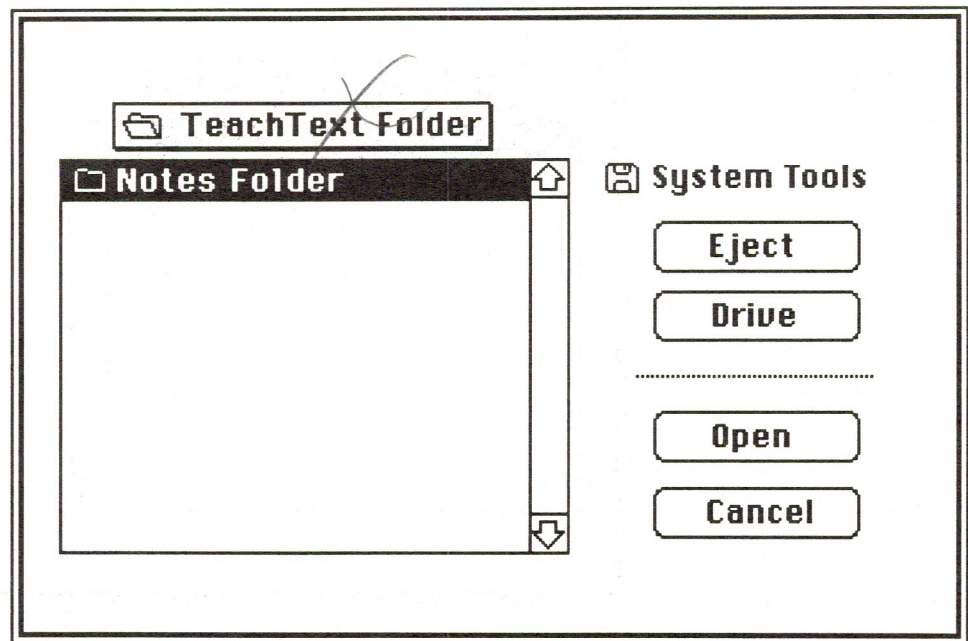
## Module Test

13. The window in the figure below displays the files in a folder. Draw an X on the part that states the name of the folder.



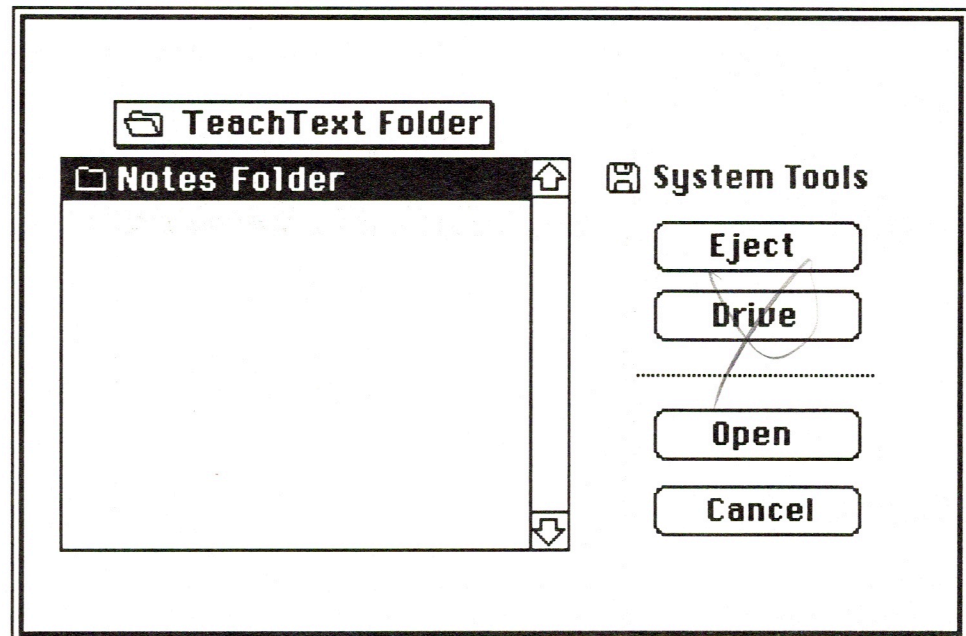
## Module Test

14. The dialog box in the figure below displays the files within the TeachText folder that are accessible from within the current application. Imagine that you want to look for a file at another directory level. Draw an X on the part that will allow you to access another directory level.



## Module Test

15. The dialog box in the figure below displays the files in the TeachText folder that are accessible from within the current application. Imagine that you want to look for a file on another disk. Draw an X on the part that will allow you to access another disk.



For items 16 through 23, indicate whether the statements are correct or incorrect by circling TRUE or FALSE.

16. When you have several windows open on your Macintosh screen, you can make a window active by choosing Active from the File menu.

TRUE

FALSE

17. When you save text to the Clipboard, the text replaces anything previously on the Clipboard.

TRUE

FALSE

# Module Test

18. When you open a document from the desktop, the application used to create the document is automatically opened.

TRUE

FALSE

19. You can nest files and folders in a folder only to five levels.

TRUE

FALSE

20. Using the Font/DA Mover, you can remove any font on a system.

TRUE

FALSE

21. When powered on, the Macintosh system software is stored in RAM and ROM.

TRUE

FALSE

22. Macintosh users use Operating System commands to arrange documents in a hierarchy.

TRUE

FALSE

## Directions

For items 23 through 29, write the answers in the spaces provided.

23. In between new versions of ROM, how are system updates provided?

*Sys updates Sys Ricks*

## Module Test

24. What is the main difference between Finder and MultiFinder?

more than 1 doc can be opened

25. Explain in your own words what a startup disk is.

Contains one file to tell hardware what to do

26. Assume that you are creating a startup disk for a Macintosh SE system with an ImageWriter II printer. What file will the user need in the System Folder to use the printer?

ImageWriter.in

27. On a Macintosh SE that has a hard disk configured as the startup disk, what do you do to boot from a diskette?

place in lower DD

28. What happens if you double-click (try to open) a suitcase file containing a font?

won't open

font DA opened

---

## Module Test

29. Here are three types of memory on Macintosh computers and a list of statements. For each statement, write the letter that corresponds to the type of memory being described.

A. RAM   B. ROM   C. Parameter RAM

- ☒ 1) Stores most of the ToolBox and Operating System
- ☐ 2) Contains data, such as Control Panel settings, that must be preserved even when the computer is turned off.
- ☐ 3) Loads and stores information from the startup disk when a system starts up.
- ☐ 4) Provides permanent, read-only memory for the system.
- ☐ 5) Stores new ToolBox and Operating System routines between ROM updates.

**Compare your answers to those provided on the following pages.**

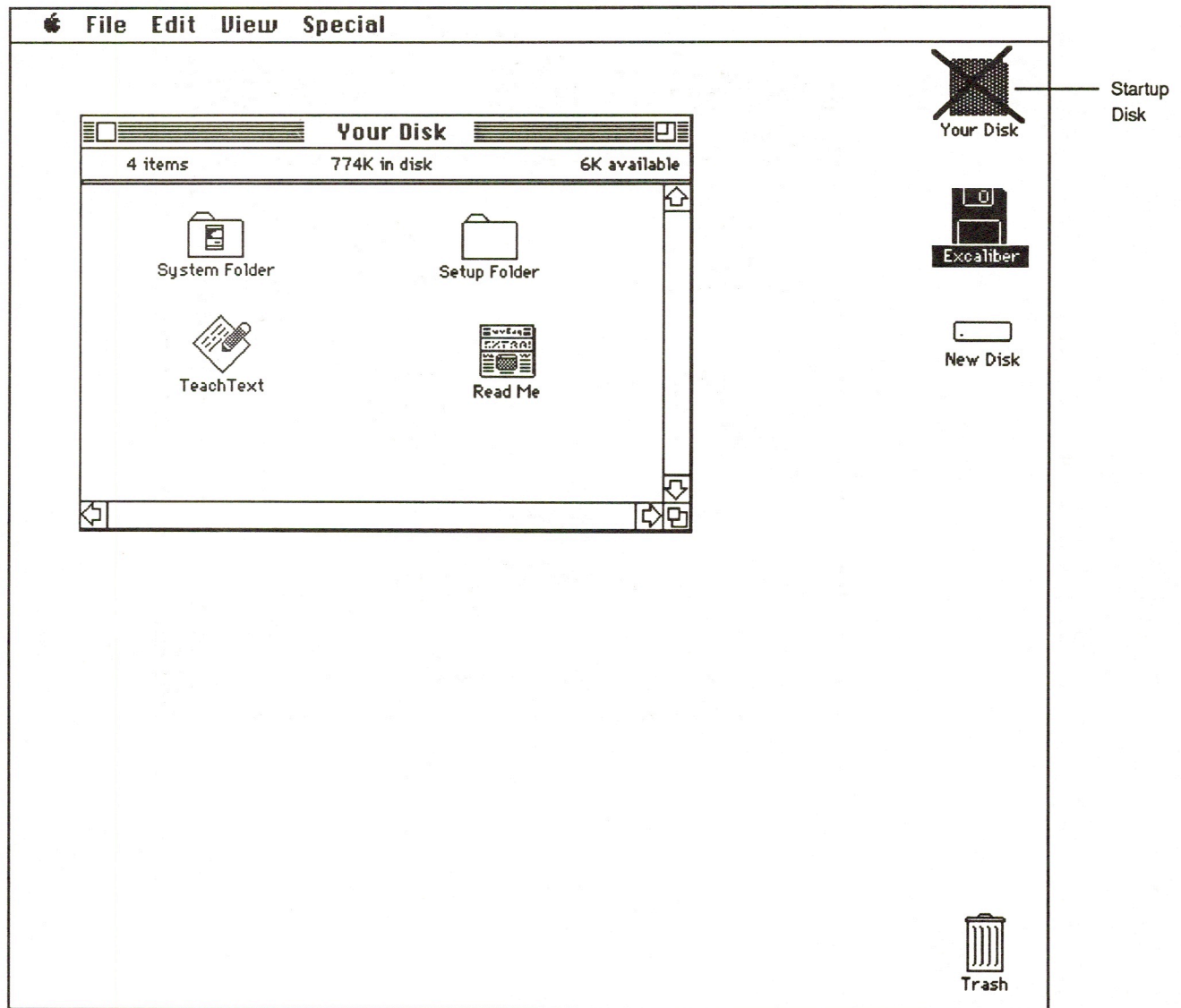
---

## Module Test (Answers)

1. B
2. A and D
3. A, B, C
4. A
5. D
6. B
7. A and C
8. B, C, D, and F
9. B. Contains QuickDraw
  - A. Is the level users always work with
  - C. Interfaces with the system hardware
  - B. Provides the user interface for all applications
  - C. Manages memory
10. F. Controls the exchange of information between an application and peripheral devices such as printers
  - A. Is a chunk of data used by Macintosh programs
  - C. Contains routines and resources required by the Macintosh, such as fonts and desk accessories
  - G. Is a set of routines grouped by function
  - B. Is a mini-application that can be run from within applications
  - H. Is an application that creates and manages the desktop
  - D. Provides the resources needed by part of the control panel
  - E. Is a program that adds, updates, and removes Macintosh software
11. 5 - any SCSI drive in descending order of ID numbers
  - 1 - the lower internal disk drive
  - 2 - the upper internal disk drive
  - 3 - any external non-SCSI drive
  - 4 - any startup drive designated on the Control Panel

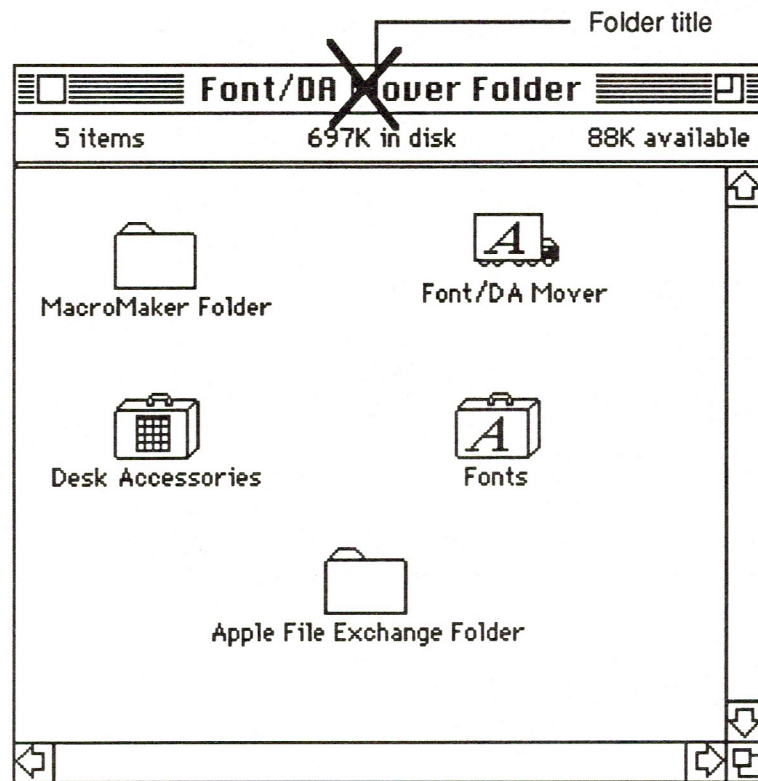
# Module Test (Answers)

12.



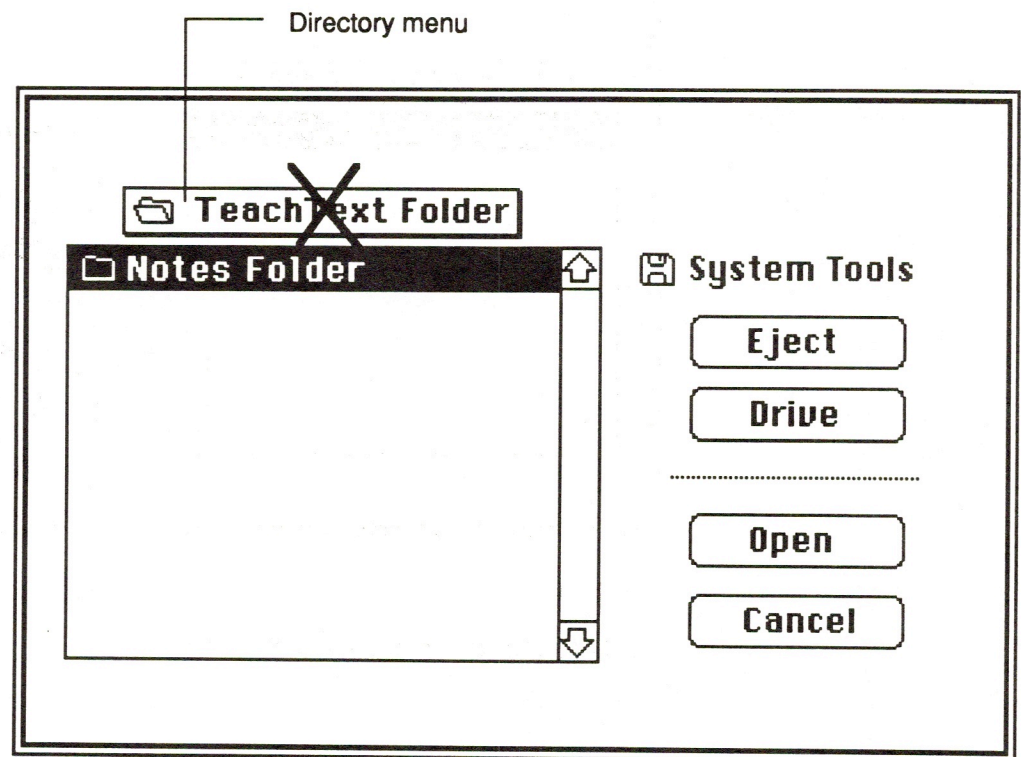
## Module Test (Answers)

13.



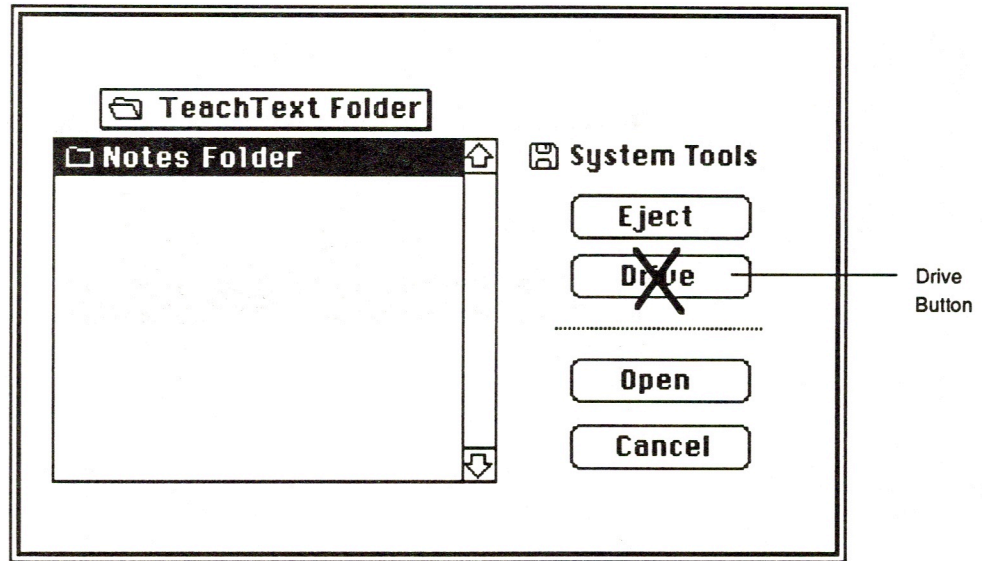
## Module Test (Answers)

14.



## Module Test (Answers)

15.



16. False, click on a window to activate it.
17. True
18. True
19. False, there's no limit to the levels of nesting.
20. False, you can't remove fonts that the system uses.
21. True
22. False, Macintosh users always work directly with applications and never work directly with the Operating System.
23. On the *Macintosh System Tools disk*
24. Multifinder allows you to have more than one application open simultaneously.

When you start up another application, the Finder closes, but MultiFinder always stays open.

---

## Module Test (Answers)

25. A startup disk provides the information required by the Macintosh to start up and run.

Any disk that contains the System File and the Finder.

26. ImageWriter file

27. Insert the diskette in the disk drive and turn on the system power (or choose Restart from the Special menu).

28. The Font/DA Mover program opens.

29. 1) B  
2) C  
3) A  
4) B  
5) A

**Reminder:** *This written test does not verify that you can perform the hands-on tasks covered in this module. Be sure you can perform the hands-on skills listed on the Skills Checklist before attending the Prerequisite Exam and the Lab part of this course.*

**Before continuing with the next module, refer to the evaluation booklet and complete the evaluation for this module.**

